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Experimental storage of corn underground and its implications for Iron Age settlements

by H. C. BOWEN and P. D. WOOD

Initial experiments in primitive agricultural practice were carried out in 1964-6 by the Ancient Fields (now Ancient Agriculture) Research Committee of the British Association for the Advancement of Science and the Council for British Archaeology. The experiments concerned ploughing with a reconstruction of a light plough, the Donneruplund ard, pulled by humans and small cattle,¹ and the storage of corn in pits underground.² The first results of the latter are reported here because of their critical importance.

I. THE INTERPRETATION OF PITS

The interpretation of pits has a bearing on the settlement, the economy and the population of the Iron Age.³ The status of an individual site, the interpretation of a whole economy and the computed population of the country can depend on a view of whether (or which) pits held corn. It is certain enough that not all were primarily for food storage. Many functions have been, or can be, suggested for particular examples, including clay puddling, storage of sling-stones, various roasting processes, latrines, and symbolic access to the Underworld. Most eventually served to hold rubbish and not a few contained burials. What the pits were for, what they held, how much they held, and for how long and by using what techniques they held it are therefore fundamental problems. In the experiments to be described here, however, the aim was to see whether modern threshed corn, selected for particular moisture contents, could be kept in pits constructed according to one interpretation of possible Iron Age practice in this country.

¹ Cf. Aberg, F.A. and Bowen, H.C.: 'Ploughing experiments with a reconstructed Donneruplund ard,' *Antiquity* 34 (1960), 144-7. The ard was made by Mr. J. F. Anstee of Reading. Dr. F. M. L. Dawson of Cambridge faced the formidable task of training a team of two of his Dexter cows.

² Financial and other assistance from the B.B.C. made this possible, through the person of Mr. Paul Johnstone. Some film was televised on 1st November, 1964 in one of the *Advance* series. Other, independent, experiments in grain storage, kindly notified by Professor B. Cunliffe, have been mainly concerned with the effect of parching, a process not used in the experiments here described.

³ The importance, in an earlier period, of pits generally much smaller than Iron Age types, has also recently been stressed. Smith, I. F., 'Note on the distribution of Neolithic storage pits', *P.P.S.* 30 (1964), 367-81.

Orthodox opinion follows or develops Dr. G. Bersu's views, based on his vitally important excavations of Little Woodbury.⁴ Thus: pits are for storage, not for living in. Pits of a certain shape and size, in the majority of Iron Age 'A' and 'B' sites, are for storing consumption corn. (Other foods are sometimes allowed.) Such pits went sour after five or ten years, necessitating replacement, so that only a few need have been in use at the same time. A large number of pits on a site may therefore indicate a long occupation rather than a numerous population.

Bersu's interpretation made sense of the remains found and threw an altogether new light on the question of 'ancient British villages', finally discrediting the existence of pit dwellings in this context.⁵ However, the lasting importance of the interpretation depends on its being used critically. There is even a need to demonstrate that it can be true, since many farmers and others refuse to believe that corn can be stored underground in our climate – and classical writers suggest that the difference between the climate of their homelands and of Britain was at least as great in the Iron Age as now.⁶ Pliny is the authority for pit storage in ancient times, but he was writing of Spain and the Mediterranean fringes.⁷ There is no reliable classical reference to such storage in early Britain.⁸

But experiment may help. If it can show that corn storage underground is feasible in Britain then it may also show *how*, for there is much less agreement amongst archaeologists on methods than on the general fact of storage. Since pits of 'storage type' could be used for other things, it would be valuable to determine what particular features might indicate corn storage. These were some of the main general points considered by the Ancient Fields Research Committee before deciding on details for the first experiments. It is virtually certain that there were some differences in Iron Age practice itself. The object therefore has been to select a successful combination of methods incorporating specific principles, such as will succeed when for instance the experiment is repeated with primitive grain.

⁴ 'Excavations at Little Woodbury, Wiltshire', *P.P.S.* 6 (1940), 30–111. Dr. Bersu was not the first to suggest that pits were for storage. General Pitt-Rivers had thought it probable in 1887 (*Excavations in Cranborne Chase* I, 12–13), but he was the first to show how it could form part of a whole economy.

⁵ The existence of the 'villages' themselves also became suspect, but some may have to be accepted for other reasons: H. C. Bowen and P. J. Fowler in A. C. Thomas (Ed.) *Rural Settlement in Roman Britain* (1966), 51–3.

⁶ e.g. Tacitus, *Agricola* 12.3, 'The climate is filthy . . .'

⁷ *Natural History*, 18, 306.

⁸ Grateful thanks are due to Professors J. M. R. Cormack, L. A. Moritz and B. R. Rees for their views on the often-quoted passage in Diodorus Siculus, *History*, V, 21, already discounted by Professor Frere, *Antiquity* XXXIII (1959), 67. It is of note that within the areas referred to by Pliny, *Natural History* 18.306, the Badajoz province of Spain, threshed wheat was being stored in pits closed by stone lids covered with 'dirt' in the early nineteenth century A.D. See Cuffie, T. H. (Ed.), *Peninsular Cavalry General*, (1951), 102. (This reference was kindly given by Mr. W. W. Stanhope-Lovell.)

One principle which it was thought might be vital was the exclusion of air from the stored corn. Tacitus said of the Germans, living in conditions more comparable with Britain than with the Mediterranean zone, that they were in the habit of hollowing out cavities (*specus*) underground and piling dung or refuse on top (*eosque multo insuper fimo onerant*). These cavities were a protection against the winter. Moreover, stores buried in such holes would escape detection by an enemy too hurried to search carefully for them.⁹ The implication is that they were set in open ground but totally covered, and therefore carefully lidded and perhaps sealed from the air.

The interpretation of the word *fimus* raises most interesting possibilities. If the primary meaning of 'dung' is taken, consideration can be given to the Matabele (South African) tradition that grain (Sorghums and maize) was bulk stored in pits dug into the floor of cattle kraals. In an actual example noted by Mr. Roger Summers, Keeper of Antiquities in the National Museum of Southern Rhodesia, beehive-shaped pits 5 ft. or more deep and up to 5 ft. in diameter, were dug into the granite sand subsoil of a late nineteenth-century sub-circular enclosure about 100 yds. across. At least one pit was sealed with a stone which covered its 2 ft. wide mouth. All the pits had some 12 ins. to 18 ins. of white ashy deposit over them, interpreted as the 'leached-out end-product of a layer of cattle dung after a comparatively short number of seasons of tropical rainfall'. Mr. Summers observes that when in use the whole area would have been sealed by the layer of dung and 'CO₂ just could not escape even if some penetrated the granite soil'. He thinks that the practice has been demonstrated in a site now dated by the radio-carbon method to between the fourth and eighth centuries A.D.¹⁰ The efficacy of dung must therefore be borne in mind as must the near-certainty that a variety of methods was practised to achieve the same result and that Tacitus may have been conflating a number of accounts. It is tempting to consider that the rubbish so often found in re-filled pits in this country may have derived from refuse of all sorts formerly piled over and around them. It is possible also that travellers had talked of small rectangular underground chambers, cellars with ramped entrances, one of which has now been found beside a late Iron Age house in S. Jutland.¹¹ But it seems most likely that he was describing storage pits of the sort widespread in Iron Age Britain and now known to have existed in Germany.¹² Covering presented no difficulty. At All

⁹ *Germania* 16, 4. Contrast the motive for underground storage in Troy VIIa, a thousand years previously. Here *pithoi* were buried flush with a surface and lidded so that they could be walked over and thus give extra room in a crowded site: C. W. Blegen, *Troy and the Trojans* (1963), 154-6.

¹⁰ At van Niekerk Ruins, Inyanga, Rhodesia: R. Summers *Inyanga* (C.U.P. 1958), chapter III, especially p. 231. For this reference, the information embodied above and other most useful observations, we are deeply indebted to Mr. Summers.

¹¹ Thomsen, N., 'Hus og kalder in Romersk Jernalder,' *KUML* (1959), 13-27.

¹² e.g. near Halle: 'Früheisenzeitliche Vorratsgrube auf der Bosenburg,' *Ausgrabungen u. Funde* 10 (1965), 29-31; near Munster: Klemens, Wilhelm, 'Eine Siedlung der vorrömischen Eisenzeit bei Sünninghausen,' *Heimatkalendar Kreis Beckum* (1967), 33-8. Our thanks are due to Dr. Michael Müller-Wille of Kiel University for his kind help in searching continental material.

Cannings Cross, for instance, 'two practically perfect examples' of gently-domed large baked cob lids were found covering pits¹³ and at Little Woodbury it was thought that unbaked clay lumps frequently found in the pits could be the remains of packing round the lids.¹⁴

Pit storage of undried grain is still practised in Africa today, and often depends for success on complete sealing, for example under clay domes.¹⁵ Bersu noted that corn was stored in deep pits in Hungary and Rumania.¹⁶ In modern Hungary, narrow-mouthed pits might have hut-like roofs though they were also covered independently by lids. Maltese grain pits, cut in tufa, are dome-lidded.¹⁷ Pits have been used for drying as well as storing corn in modern Cyprus, fires being lit in them and the ashes cleared out before they were filled with corn and sealed.¹⁸ Some of the latest commercial methods of storing also rely on the principle of sealing.¹⁹ Here, undried corn with a moisture content of about 22% is most effective, actually providing its own protection. The corn uses up oxygen and gives off carbon dioxide, thus reducing fermentation, inhibiting harmful bacteria, yeasts and moulds, and protecting against insects and rodents. Since calcium carbonate itself gives off carbon dioxide, storage in chalk or limestone may enhance this.

Probably, though not certainly, corn in the Iron Age was dried before storage. There is little doubt that most corn *was* dried, if not for storage then to facilitate threshing or grinding. The over-dried (or just burned) carbonized corn occasionally found in pits is mostly either rubbish or was stored, one would suppose, for some purpose other than making bread or porridge.²⁰ It is not altogether frivolous to remember charcoal biscuits or even pigment. The fact of its preservation to the present day puts this carbonized grain into a different category from ordinary corn, though allowance must still be made for the occasional possibility of spontaneous combustion or even for some carbonized grain being the residue from a store otherwise long rotted away.

Bersu thought that the 'deeper pits' at Little Woodbury were used for storage. The capacity of each, unlined, was 1½ to 2 cubic metres (i.e. about 50 to

¹³ Cunnington, M. E., *The Early Iron Age inhabited site at All Cannings Cross Farm, Wiltshire* (1923), 61.

¹⁴ Bersu, *op. cit.* fn. 4, 61.

¹⁵ Hall, D. W., Haswell, G. A. and Oxley, T. A., *Underground storage of grain* (Colonial Research Studies, 21) (H.M.S.O. 1956). The same principle is applied to the storage of beans in Egypt: Attia, R. 'Typical methods of handling and storing grain in Egypt', *F.A.O. Agricultural Studies* 2 (1948), 105-6.

¹⁶ Bersu, *op. cit.* fn. 4, 60. Cf. Buttler, W. 'Pits and pit-dwellings in east Europe', *Antiquity* 10 (1936), 27 ff.

¹⁷ Personal communication from Mr. R. S. Newall.

¹⁸ When covered over, they were conveniently hidden from tax collectors. Note in *Antiquity* 30 (1956), 22.

¹⁹ Culpin, C. 'High-moisture grain storage', *Agriculture* 71 (1964), 256-9.

²⁰ Although such carbonised corn is sometimes found mixed with other rubbish it has also been found by itself, for example on the floor of Fifield Bavant Down pit no. 46. Clay, R.C.C., 'An Early Iron Age site on Fifield Bavant Down', *Wilts. Arch. Mag.* 42 (1924). In one instance, Itford Hill pit no. 26, 11½ lbs. of barley was found piled on the floor of a small pit like Bersu's type 'A', i.e. *not* of accepted storage type (Burstow, G. P. and Holleyman, G. A., 'Late Bronze Age settlement on Itford Hill, Sussex', *P.P.S.* 23 (1957), 177-8.)

70 cu. ft.). They were approximately round in horizontal cross-section and either narrow-necked (like a beehive, barrel or truncated cone) or cylindrical. These forms and sizes recur on other chalk sites. In gravel, the pits tend to be shallower and have to be straight-sided.²¹

Pits in friable rock and on the damp sites to be expected in British climates present a great problem. The usual lack of collapse suggests that pit sides were generally protected from the weather and also lined in some way even though direct evidence of lining has seldom been recorded. Bersu assumed that the pit contents would have to be preserved in some sort of container.²² He seems to have regarded it as a separate receptacle rather than a true lining, but sufficient to hold up the pit sides. He thought it might have been made of wickerwork—wickerwork and straw matting are well known in the Neolithic pits of Egypt²³—though such distant comparison is best avoided. Closer at home, at the Iron Age Dane's Camp, Conderton, Gloucester, Nicholas Thomas has found traces of 'clay lining and also of some form of basketry which included upright stakes about the size of a man's thumb'.²⁴ In certain instances, even on the chalk, limestone has been imported to make a dry-stone wall lining, the floor also sometimes being paved.²⁵ In another chalk site, a rebate of flints was raised to 2 ft. above the floor level as if to hold a wooden floor above a soaker.²⁶ Pliny recommended merely that the floor be covered with chaff.²⁷

II. THE EXPERIMENTS

Introduction

The experiments already referred to were begun by the Ancient Fields Research Committee in the autumn of 1964.²⁸ The aim was to test the practicability of storing corn underground, having in mind the probability that the practice was widespread in much of S. Britain particularly during the Iron Age. Much of the virtue of such experiment lies in facing the same sort of problems as the Iron Age farmers and would ideally be conducted in a permanent reconstruction of a working farm of the period. Absolute data is often unobtainable but considerable knowledge is gained of orders of magnitude, of practical difficulties, of the possible effects of certain actions and thus of what can be looked for in excavation of actual sites. The factual description that is given here is of a 'proto-experiment'. It showed that certain modern corn can be

²¹ cf. Bradford, J. S. P., 'An Early Iron Age settlement at Standlake, Oxon', *Antiq. Jour.* 22 (1942), 204 ff.

²² Bersu, *op. cit.* fn. 4, 60.

²³ Childe, V. G., *New Light on the Most Ancient East* (1952), 35–7.

²⁴ Information kindly given in a letter from Mr. Thomas.

²⁵ cf. Wheeler, R. E. M. *Maiden Castle Dorset* (1943), pl. 90 (site Q).

²⁶ Barn Down West, Winterbourne, Wilts. *Wilts. Arch. Mag.* 60 (1965), 58.

²⁷ *Natural History*, *loc. cit.*

²⁸ A brief note appeared in *Antiquity* (Sept. 1967), 214–15.

preserved over an English winter in pits that sought to simulate Iron Age types but were sealed by using modern materials in the covering. The Committee is now considering how best to institute experiment into a wide range of ancient agricultural practice carried out with adequate repetition and expertise over a long period of years. The following notes are offered at this stage because they may stimulate constructive criticism and because it was thought desirable to discuss the implications of an unexpected discovery about pit capacity. It must however be emphasised that these were experiments in experiment, with strictly limited objectives which deliberately took no account of the multitude of points which, given time, can be considered in the matters of corn storage and the use of pits.

The Experiments

These were carried out over the winters of 1964/5 and 1965/6 to test the storage of modern materials. The corn used was modern because only very small quantities of primitive strains were available.²⁹ The sealing of the pits from the air as well as from the weather was regarded as important for reasons already given.

The site used for the experiment was amongst 'Celtic' fields on land belonging to Stoke Farm, Broad Chalke, Wiltshire on Upper Chalk, 420 ft. above O.D. on the east side of a south-facing spur at SU 053271 (O.S. 1" Sheet 167).³⁰ This particular area had probably not been cultivated for 1500 years. Soil was some 9 ins. thick. The surface sloped 3° S and E.

Four pits were dug in July, 1964 Fig. (1). Two, (1) and (2), were of a size and shape to come within the definition of deep storage pits as classified by Dr. Bersu. One, (b), was a miniature version of (2), and (a) was a small pit, shallower than broad, in which certain precautions carefully taken for the three other pits were deliberately ignored.

The lids in the first year's experiment were of modern plywood because one of the main objects was to achieve an air seal and because the experiment was mounted quickly with the unexpected, generous and very welcome assistance of the B.B.C., who had a timetable to keep.³¹

In the second year the lids were made of cob, a mixture of chalk and clay built up on wicker frames made by Mr. W. Shelley.³² Mr. Shelley also made the

²⁹ *Spelt* and *emmer* to provide seed for further cultivation and subsequent storage are now being grown by members of the Committee and other helpers.

³⁰ The land was made available by the late Mr. J. F. H. Thomas, a Committee member whose other essential contributions included advice, materials and the services of expert and enthusiastic farm workers.

³¹ Some film was televised on 1 November 1964 in one of the *Advance* series produced by Mr. Paul Johnstone.

³² Lids of comparable shape but of baked cob were found roofing certain pits at All Cannings Cross (M. E. Cunington, *The Early Iron Age inhabited site at All Cannings Cross* (1923), 61). Fragments of cob lids were also found at Little Woodbury, many pierced with holes and bearing the impression of wattle (*P.P.S.* XV (1949), 159). Dr. Bersu had regarded these as covers for corn drying ovens (*P.P.S.* VI (1940), 53).

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basketry linings for the pits. It is his expert opinion that linings cannot be made in pits, since it is necessary to work from the outside. When asked how a basket lining could be made for a pit with mouth narrower than base, he suggested manufacture in a long strip which could be coiled for insertion and then opened out to fit. This he did for the two deep pits, weaving a shoulder to one which, when coiled, assumed a bell shape (Plate Ia). The pattern of the wattle was based on examples preserved at Glastonbury.³³ All but pit (a) were floored with some 6 inches of chopped straw to simulate the chaff advocated by Pliny.³⁴

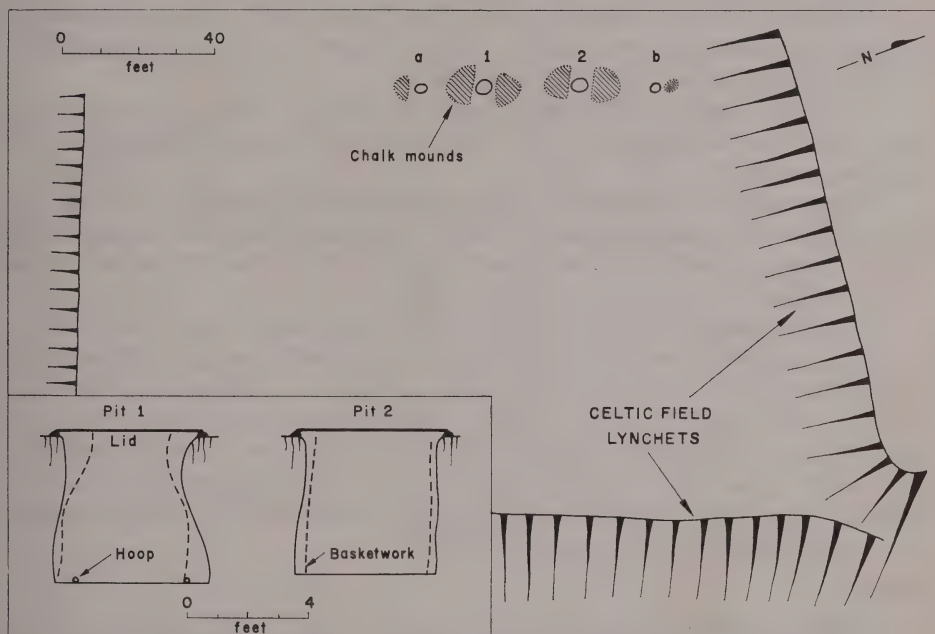


Figure 1 Experimental storage pits, Broad Chalke

The brief history of each pit in two seasons is as follows:

1964-5. (All pits filled on 20 September, 1964 and opened on 19 March, 1965).

Pit (1)

Dug first to a cylinder 4 ft. 6 ins. deep, 4 ft. wide, volume 56 cu. ft. = 1.6 cu.m. Work was hampered by tabular flint at c. 4 ft. deep. It took two men with modern pick and shovel 8 hours to dig. Experiment also showed that a

³³ Bulleid, A. and Gray, H. St. G., *The Glastonbury Lake Village* (1911), 340.

³⁴ *Natural History* 18, 306.

Red Deer antler was an effective and convenient tool. This pit was later undercut by working out symmetrically from an osier pegged by antler tines to the original junction of floor and side to form a truncated cone of 70 cu. ft. It had been found impossible to make an overhang at a high level without collapse and the bell- or beehive-shaped basket coil was eventually inserted and filled in with rubble and earth above the shoulder. The basketry strip 17 ft. long and nearly 5 ft. deep took the expert basket-maker 18 hours to weave outside the pit. Fitting took about 30 minutes. A gap was left at most points between basketry and pit-side. Capacity was reduced to 55 cu. ft., a little over 1.5 cu. m.

When the pit was about to be filled, two months after construction, fungal growth was observed in the basketry where it was in contact with the rubble packing pressed against the shoulder.

Forty-four bushels of barley as moist as could be found in a dry season were poured in, 18 bushels at 21%, 2 bushels at 18% and 24 bushels at 17% moisture content.

Copper pipes for aspirating CO₂ were arranged at depths of 19 ins. and 41 ins. below a batten under the lid, which supported them. The lid was bedded in a clay ring protected by an asbestos sheet over it, and the whole covered with a rubble mound up to 1 ft. 3 ins. high.

When opened after a mild winter, which ended with a heavy fall of snow, it was found that the corn had generally kept well though field mice had broken the seal and eaten the corn to a depth of ten inches on one side of the pit. One lump of chalk had been nibbled to egg shape and size by the mice. Water, let in by the mice, had rotted the basket work, which collapsed. The moisture content of the grain was 21½%; temperature was 8°C–13°C; germination of centre samples was 92% after 4 days and 50% from side samples. Other side samples after 7 days reached 72%.

Pit (2)

Dug to cylinder same size as (1) in 3 hours, unhampered by flint. Internal size with cylindrical basketry was 4 ft. 5 ins. deep and 4 ft. 1 in. across, volume about 55 cu. ft. = 1.5 cu. m. 44 bushels barley, 14½% moisture content, dry enough not to require artificial parching, was used exactly as in (1) (Plate Ib).

When opened the corn had generally kept well. Moisture content was 16%, temperature 7°C, in the centre at depth 3 ft. 4 ins. Germination 92% after 4 days; 96% after 7 days.

In both the above pits the chopped straw, 8 ins. thick, had been compressed to ½ in. CO₂ readings, supplied by Mr. D. Callow, who went to great trouble to get them, are given in fig. 2.

Pit (b)

Pit (b) was cylindrical, 2 ft. wide and deep, lined with a tight-fitting rigid basket. There were no aspiration pipes, but otherwise it was treated as (1) and

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(2). Corn put in at 17% moisture content kept generally well. Temperature at 11 ins. was $6\frac{1}{2}^{\circ}\text{C}$. Germination was 65% after 4 days, 95% after 7 days.

Pit (a)

Pit (a) was round, 3 ft. across and 2 ft. deep, lined with a rigid basket. A bushel of barley of 17% moisture content was poured direct on to the chalk floor. The pit was covered by a wooden lid without clay seal and weighted under asbestos without any rubble mound above. The corn sprouted thickly after 7 weeks and was a brown mess by March. The basketry was mouldy and rotten.

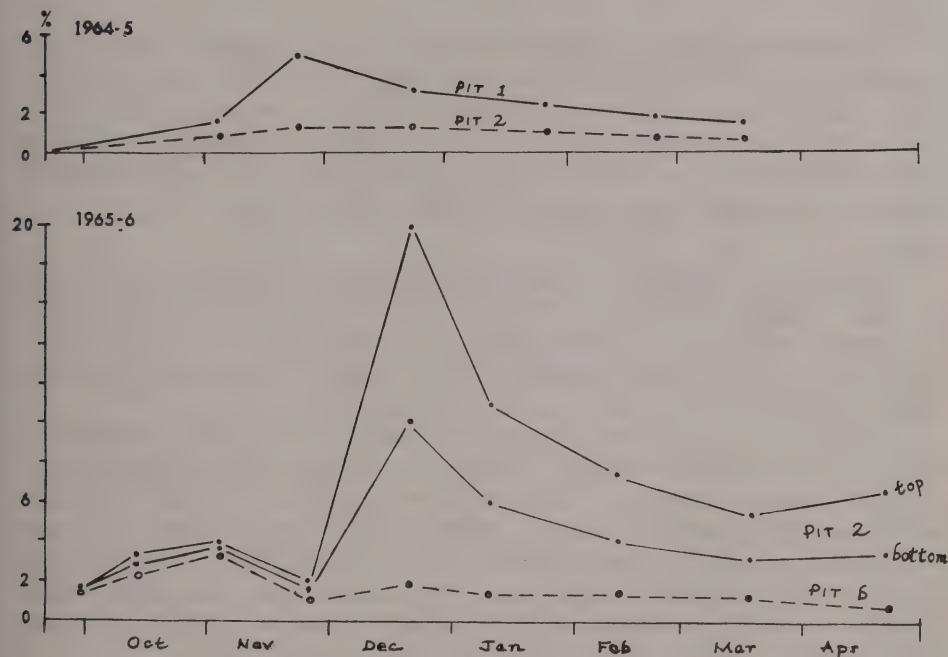


Figure 2 Analysis of Carbon Dioxide from pits. In 1965-66 readings are given from aspiration pipes in upper and lower half of pit 2.

General Considerations

Modern barley can be kept in adequately sealed pits underground in a mild winter. Mice form a major danger to the sealing arrangements. All the corn, except that from (a), was fed to stock. It was found essential to remove the basketry linings for drying before a second season. When the linings were out and the pits only loosely covered there was a marked tendency for chalk in the lower levels of the pits to collapse and thus produce a beehive-shape quite unintentionally.

1965-6. (Two pits only, both filled September 1965 and opened 22 April, 1966.)

After the opening of pits in March 1965 (1) and (a) were abandoned and filled with rubble. Dried basketry was replaced in pits (2) and (b) and in September they were once more filled with modern barley, all of it notably 'wet' at about 26% moisture content. The other main difference was that the lids were made of cob, as already noted. It needed 8 adults to carry the bigger of these lids, which also cracked easily, so for these reasons alone it must be supposed that any such lids would have been built up *in situ*, possibly on straw laid directly on the corn. After October, the winter was wet, with 20 ins. of rain.

Pit (2)

By the date of opening the lid had sunk some 3 ins. in the middle. Much water had got into the pit, partly through cracks in the cob, partly along the surface. Rodents had again broken the clay seals. Corn temperature 23°-26°C. in top 1 ft. 6 ins., 13°C at 3 ft. The corn was black at the top and bottom (where the chopped straw was rotten) but elsewhere the colour was little affected. The corn was mouldy in pockets and was not fed to stock.

Pit (b)

The corn for a depth of 4½ ins. under the lid had been curiously replaced by earth. Temperature was *c.* 12°C, colour of corn largely unchanged but considerable germination and mouldiness. Not fed to stock.

The CO₂ graph, again supplied by Mr. Callow, is shown in Fig. 2, this time showing the readings for one of the miniature pits.

Moulds growing on the grain and basketwork were examined by Mr. P. C. K. Austwick and Dr. J. Lacey. *Penicillium cyclopium* was the predominant mould in most grain samples from all pits in both years although many other fungi were also isolated. Thermophilic fungi actinomycetes were rare in most samples but were abundant in those from the top 1 ft. to 2 ft. of pit (2) after the 1965/6 experiment. This suggests that this grain heated initially to 50-60°C. A number of these organisms are harmful to man, and they include the actinomycetes which cause farmer's lung disease.

Finally, for ease of comparison, some basic data are summarized in the following table:

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Pit Type	Approx. Depth	Width	Bushel Capacity	Moisture content	Lid	Filled	Max CO ₂	Opened	Result	Moisture	Temperature	Germi- nation Test
1 Beehive	4' 4"	2' 8"- 4' 2"	44	17-21 %	Sealed wood under asbestos	23rd Sept.	5.4 %	19th Mar.	Kept	21½ %	8-13°C.	50-92 %
2 Cylinder	4' 5"	4' 1"	44	14½ %	Sealed wood under asbestos	22nd Sept.	1.8 %	19th Mar.	Kept	16 %	7°C.	92-96 %
a Miniature, wider than deep	1' 11"	3' 0"	1		Unsealed wood under asbestos	23rd Sept.	—		Ruined by 12th Nov.			
b Miniature	1' 11"	1' 11"	3	17 %		23rd Sept.	—	19th Mar.	Kept		6½°C.	65-95 %

1965/66

2 As above				26 %	Unbaked cob on basketry	30th Sept.	20 %	22nd Apr.	Mostly mouldy		11-26°C.	
b As above				26 %	Unbaked cob on basketry	30th Sept.	3½ %	22nd Apr.	Mouldy throughout		10-11°C.	

NOTE:

All were lined with basketry
 All but (a) had 8" chopped straw on floor
 All but (a) were filled to top
 Basketry of (1) broken during opening and deliberately buried in rubble re-fill 1965. Basketry of (b) similar 1966.

III. SOME IMPLICATIONS

One result of the experiment is to make desirable a re-appraisal of some of the conclusions based on the excavation of Little Woodbury. In a critical footnote Bersu calculated that 12 typical pits, totalling 18 cu. metres, would hold altogether 55 bushels.³⁵ His metric statement of volume is, of course, accurate, and corresponds with the capacities of the larger Broad Chalke pits. However, the transference to the British bushel measure (in a report prepared under the most difficult of wartime conditions)³⁶ produced a considerable miscalculation. In actual fact (since 1 cu. m. = 35.3 cu. ft. = 27.5 bushels) the 12 pits would have held about 495 bushels, exactly nine times more than Bersu postulated and, furthermore, than he used in his report as a basis for calculating the arable acreage and the population at Little Woodbury.

To consider acreage first. Bersu calculated that only 12 pits were open at a time, assuming a life of 10 years.³⁷ To his total of 55 bushels, he added a further one third for seed corn stored above ground in granaries, giving a grand total of 73 bushels harvested each year. He considered that a normal yield might be 11 bushels per acre, and that this indicated an annual arable acreage of 5 to 7 acres. He furthermore postulated a two-third fallow system, requiring a total area of some 20 acres. If the nine times correction is applied to Bersu's own criteria, the annual arable area becomes about 60 acres, the total farmland about 180 acres. However, quite apart from the inaccuracy over volumes, re-appraisals of his other postulates, like yield per acre, amount of seed corn, the proportion of fallow, are all essential and must be the subject of experimental investigation.

The population can be calculated even less finely. Bersu considered the numbers to be small, allowing at most 'several families'.³⁸ This estimate he based on the single big house he found, the long period of occupation, and the paucity of finds, as well as on the small capacity of the pits open at a time. In conjunction with the latter, he spoke of the annual consumption of wheat, noting that in 1939 this was said to be $4\frac{1}{2}$ bushels per head annually in the U.K.³⁹ If his computed yield, less seed, were all consumed this would hint at a population of about 14 people. Applying the new correction, the maximum population could now be nine times 'several families' or, on Bersu's corn-consumption basis, some 110 people. But again there are difficulties requiring consideration.⁴⁰

³⁵ Bersu, *op. cit.* fn. 4, 64.

³⁶ Bersu, *op. cit.* fn. 4, 111.

³⁷ Fumigation might have extended this period, but Bersu was positive that no fires had been lit in any pit, *op. cit.* fn. 4, 61.

³⁸ Bersu, *op. cit.* fn. 4, 101.

³⁹ Bersu, *op. cit.* fn. 4, 104. This figure, even in 1939, was almost certainly too high. It is significantly less today (*Domestic Food Consumption and Expenditure*, H.M.S.O. annually).

⁴⁰ Professor Alfred Moritz points out in correspondence the pitfalls of using modern figures, 'if only because much of the starch now comes from potatoes . . . Cato (*Agr.*, 56) gives rations for Roman slaves. Here the

Is Bersu's premise, that acreage and population can be calculated from total pit capacity, a valid one at all? If, as seems likely, deep pits were indeed used for corn storage there is a principle here which can be used, though never precisely, if we can determine *which* pits held corn and how many were open at a time. It is quite certain from other sites that not all deep pits were used for corn and this was something well recognized by Bersu, though not allowed for in his calculations. Another very important point is that his calculations of yield related to threshed corn, and it can be argued that such calculations should allow for the probability that corn was stored in the ear. A considerable quantity of unthreshed heads of corn was once identified in an Iron Age pit at Little Solsbury, near Bath.⁴¹ Although the presence of carbonized (i.e. charred) corn is no proof that ordinary corn was so stored, this find is a reminder of Pliny's note that in the Mediterranean zone corn was pit-stored in the ear, and of statements by Diodorus Siculus and Strabo that in Britain corn was harvested by cutting just below the ear.⁴² Storage in this form would reduce, perhaps to somewhere between one half and one third (depending on type of cereal and subject to further experiment),⁴³ the actual amounts of grain stored, and all the figures dependent on the storage total. For example, the reduction would give a corrected area of 60 to 90 acres for Little Woodbury's farmland. Independent evidence suggests that this is much nearer the minimum figure to be allowed for than Bersu's original 20 acres. 'Celtic' fields directly associated with the 'Little Woodbury' type settlement by Farley Mount, west of Winchester, can be seen covering 60 acres and, as an R.A.F. vertical air photograph shows, they formerly extended farther.⁴⁴ But the storage of ear rather than threshed grain is an immensely difficult thing to prove, and further research must also be done on ratios of grain to ear.

An outstanding point for resolution is why there were so many pits in Little Woodbury and sites of similar type, and relatively so few in certain major hill-forts. Bersu suggested that at Little Woodbury only one major house

most frequent figure mentioned is 4 *modii* per month . . . Four *modii* equals 0.96 imperial bushels. So (these) rations are more like 11½ bushels per year.'

The Roman legionary's bread grain ration was at the rate of c. 14½ bushels per annum (Webster, G., *The Roman Army* (Chester 1956), 31). B. H. S. van Bath (*Agrarian history of Western Europe* (London 1963), 86) mentions the wheat consumption of a German farm worker in 1815 at an annual rate of c. 13½ bushels. All these figures thus point to a consumption of about three times the figure which Bersu incorporated in his account. It is worth recalling, however, that Athenaeus (IV, 36, p. 151E) thought the (continental) Celts ate meat more than bread, at any rate at feasts. Dietary preferences obviously have their part to play, but in the final resort the grain consumption for Little Woodbury, as for any other community, was inevitably limited by what was available.

⁴¹ Observed by Mr. C. W. Phillips in the mid-1920s. Professor Percival noted that it was in the ear. Percival: *Wheat in Great Britain* (1948), 18; Jessen, K. and Helbaek, H., *Cereals in Great Britain in prehistoric and early historic times* (1944), 13.

⁴² Diodorus Siculus, *History*, 5, 21.5; Strabo, *Geography*, 4.5.5.

⁴³ Calculations based on modern two-row barley (variety Vada) indicate that the grain contained in ears tightly compressed in a container account for 40% of the total volume.

⁴⁴ Bowen and Fowler in A. C. Thomas (Ed.) *op. cit.* fn. 5, 45 and Plate VI.

existed, but he estimates the total number of deeper pits at 360.⁴⁵ In some known hill-forts where huts are recognizable the proportion of pits to houses is very much less. In Hod Hill, Dorset, the relationship is in the order of 2 or 3 pits to 1 house.⁴⁶ Bersu explained the discrepancy in general terms by suggesting that hill-forts were places of refuge only temporarily occupied. An alternative explanation would be that pits were not only nine times more capacious but also lasted much longer than the ten years that Bersu believed possible. Should this be so, the pit evidence at Little Woodbury indicates considerably more people than would fit into the one house. It then has to be considered whether this involves a population living outside. Little Woodbury probably has to be viewed as something more than a simple farm, and some sites, on pit numbers and consequent storage capacity alone, may have to be restored to 'village' status.⁴⁷ In considering Iron Age population as a whole it is also necessary to allow for arable settlements, even in the south of England, where pits were scarcely used and therefore not left as evidence.

There are thus a multitude of imponderable and unknown quantities, connected with yields, cultivation methods and habits. Nevertheless, to recapitulate the considerations here reviewed, pits can hold nine times as much as was allowed for in the Little Woodbury report. It is not, however, safe to assume that because of this Bersu's calculations of acreage and population can be multiplied by nine, since (i) perhaps not all the pits of appropriate size were used for corn; (ii) the corn may have been kept in the ear, reducing the grain stored to at most one half or one third of the threshed content; (iii) the amount held was reduced if a pit lining was used; (iv) the life of a pit is quite unknown and the ten years postulated was only a guess; (v) individual consumption of corn could have been much higher than the modern figures suggest; (vi) the life of a pit may depend on the type of lining and cover used and on whether, for example, fumigation was practised. The relatively few pits in some hill-forts could suggest a longer life. This in turn could indicate a greater population at Little Woodbury. We can never obtain exactitude, but the present evidence can be interpreted to indicate that Little Woodbury had an associated arable acreage considerably greater, and a population probably greater, than suggested by Bersu. Whether the people all lived within the confines of the enclosure is a debatable point which involves the status of that type of settlement.

⁴⁵ Out of 120 'deeper pits' in the excavated area, the table on p. 51 of Bersu's report shows only 86 of type C-F deeper than 1 metre.

⁴⁶ According to a calculation based on a plan of R.C.H.M. (England) and on air photographs the total number of pits in the 52 acre interior was around 700.

⁴⁷ e.g. Boscombe Down West, Wilts., site Q, pits covering 16 acres plus. Richardson, K. M., 'The Excavation of Iron Age villages on Boscombe Down West', *Wilts Arch. Mag.* 34 (1951), 123-68. Some enclosures also enclosed groups of huts dissimilar from Little Woodbury, e.g. Heath Row, Middlesex and Hog Cliff Hill, Dorset.



(a) Pit 1 basketry lining showing "fully-fashioned" form. Mr. Shelley, who made it, on the right. Mr. Gulliver, an invaluable helper, on the left. Photograph by Mr. Paul Johnstone.



(b) Pit 2, 1964, with aspiration pipes in position and the corn that it held stacked in bags on left. Photograph by Mr. K. Grinstead.

The Stone Industries of Abri Bergy, Lebanon

by L. COPELAND and J. WAECHTER

The last excavation of this small site, which is about 8 km. north of Beirut, was carried out by Father J. F. Ewing, S.J., during the course of the Boston College excavation at Ksar 'Akil further down the valley. In view of the interest of this material in relation to the Upper Palaeolithic/Mesolithic problems of the Middle East, and the almost total destruction of the site by quarrying, it is felt that this material should be made available and its significance discussed in some detail.¹

Location

The site is situated in a limestone cliff above the banks of the Wadi Antelias, one of the many winter streams which flow west from the mountains, across the narrow coastal plain, and into the Mediterranean. The cliff is about 2km. above the point where the ravine opens out onto the coastal plain. Abri Bergy is actually a small cave, a narrow fissure below an overhang; under this was a talus formed of occupation deposits which sloped down 3.50 m. to the present stream-bed level. About 36 m. downstream, in the same cliff-line, is (or was) Antelias Cave, published first by Zumoffen,² and about 200 m. further on is the junction of this wadi with another, which is the location of the important shelter of Ksar 'Akil.³ Although these wadis are dry in summer, the present-day inhabitants of the area rely upon a very large spring, the Faour Antelias, which gushes from a cave on the opposite side of the valley just below the junction. The present sea-shore is about $2\frac{1}{2}$ km. to the west.

History

The site was almost certainly one of those which Zumoffen⁴ noted as existing in the vicinity. Père Bergy (after whom the shelter is named) first sounded the talus at the cave-mouth⁵; he considered the industry microlithic

¹ This was included in the Ksar 'Akil material made available for study by Father Ewing.

² Zumoffen, G. 'L'Age de la Pierre en Phénicie', *L'Anthropologie* 8 (1897), 272-283 and 426-438.

³ Ewing, J. F. 'Preliminary note on the excavations at the Palaeolithic site of Ksar 'Akil, Republic of Lebanon', *Antiquity* 21 (1947), 186.

⁴ Zumoffen, G. *op. cit.* fn. (2).

⁵ Bergy, P. 'Le paléolithique ancien stratifié à Ras Beyrouth', *Mélanges Univ. St. Joseph*, Beirut 16 (1932), fasc. 5, 175.

('Capsien'). His material, which largely complements that described here, is in the Université St. Joseph, Beirut. Ewing notes that Bergy also found human remains which have not survived⁶; Bergy's notebooks (which, together with some human bone fragments, do survive in the Université St. Joseph) describe these and the circumstances under which others were pilfered. Ewing made a small excavation in 1947-48, also finding human remains (now at Fordham University, unpublished), and an industry which he noted 'had more microliths than in the topmost levels at Ksar 'Akil'.⁷ It is this material, at present in the Institute of Archaeology, University of London, which is the subject of this



Fig. 1

- 1 Antelias Spring
- 2 Ksar 'Akil

- 3 Antelias Cave
- 4 Abri Bergy

article. D. Hooijer examined other bones sent him by Ewing, finding (as at Antelias) a predominance of *Dama* and *Capra*.⁸ Regrettably, the limestone ridge separating the two wadis has been gradually destroyed by dynamite during quarrying operations; Antelias Cave disappeared in 1965, and Père Hours informs us (personal communication, 1967) that Abri Bergy has now also been destroyed.

⁶ Ewing, J. F. 'List of Fossil Men in Lebanon', *Catalogue des Hommes Fossiles*, XXth session International Geological Congress, Algiers (1953), 311-313.

⁷ Ewing, J. F. *op. cit.* fn. (6).

⁸ Hooijer, D. 'The Fossil Vertebrates of Ksar 'Akil, a Palaeolithic rock-shelter in the Lebanon', *Zoologische Verhandelingen* 49 (1961), 1.

Description of the flint material

Ewing excavated five layers of deposits (numbered V to I). We have no information as to the depths of the levels, nor the composition of the deposits.

For convenience the layers are described from the bottom upwards. The material is fine-grained grey chert throughout.

LAYER V

Kebarah Points. One (Fig. 2, 2). This is quite typical of the oblique-ended variety from Kebarah C, though not so well made as the type specimens. The retouch is steep and extends up the length of the back and across the oblique end.

Backed Blades. Ten (Fig. 2, 5–10). This is a very poor group with the exception of 9. The retouch on all is very fine and the blades vary greatly in form and size.

Retouched Blades. Seventeen (Fig. 2, 1, 11–14). These range from the unusual specimens, 13–14, to the more general type of small blades with slight retouch on some part of the back. 1 is longer than the majority and the fine retouch is confined to the base. In 13 and 14 the retouch is steep and heavy and in the case of 14 there is inverse retouch along the whole of the opposite edge.

Notched Blades. One (Fig. 2, 15). This has fine retouch towards the base and a well-made notch further up the same side; on the opposite edge there is slight inverse retouch.

End-scrapers on Blades. Three (Fig. 2, 16, 18, 19). These are quite typical though not very well made. In 19 the retouch is very rough and the working edge almost straight.

Steep-scrapers. Two (Fig. 3, 6). The illustrated specimen is atypical, being made on a thick flake with rough retouch on the end and part way down one side; the working-edge is very irregular, almost denticulated. The second example, equally rough, is made on a broken core.

Core-scrapers. Two (Fig. 3, 1, 5). Both are small blade cores of prismatic type, modified into scrapers. Fig. 3, 5 has two working edges.

Burins. Nine (Fig. 2, 17; Fig. 3, 2–4). This is a very poor group which almost defies classification. Fig. 3, 2 is a double burin on a truncation; Fig. 3, 4 is a double flat burin against a single facet; one is a single facet against a truncation at both ends, and Fig. 3, 3 is technically a polyhedric with four facets against one. The remainder are single facets against an oblique truncation.

Blades. Fourteen: Medium (7–4.5 cm.): 8

Small (4.5–2.5 cm.): 6

These are generally rather broad, particularly the larger group.

Cores. Five: Two are single ended prismatic cores, one is globular and the others are fragments.

Flakes. Eleven. No special comment.

LAYER V: INVENTORY

		%			%
Kebarah Points	1	1.33	Core-scrapers	2	2.66
Backed Blades	10	13.33	Burins	9	12.00
Retouched Blades	17	22.66	Blades	14	18.66
Notched Blades	1	1.33	Cores	5	6.66
End-scrapers on Blades	3	4.00	Flakes	11	14.66
Steep-scrapers	2	2.66		—	—
			Total	75	—

LAYER IV

Kebarah Points. Two (Fig. 4, 3–4). Both are typical of the oblique form. In 4 the angle between the back and the oblique end is more pronounced, as in the examples from Kebarah.

Blades with transverse truncation. Two (Fig. 4, 1–2). These belong to D. de S. Bordes' general group of 'Pièces à bord abbattu tronquées', type 64 of the *Lexique*.⁹ Their size however suggests that they

⁹ Sonnevile-Bordes, D. de. and Perrot, J. 'Lexique typologique du paléolithique supérieur', *Bull. Soc. Prehist. Française* 53 (1956) 547–559.

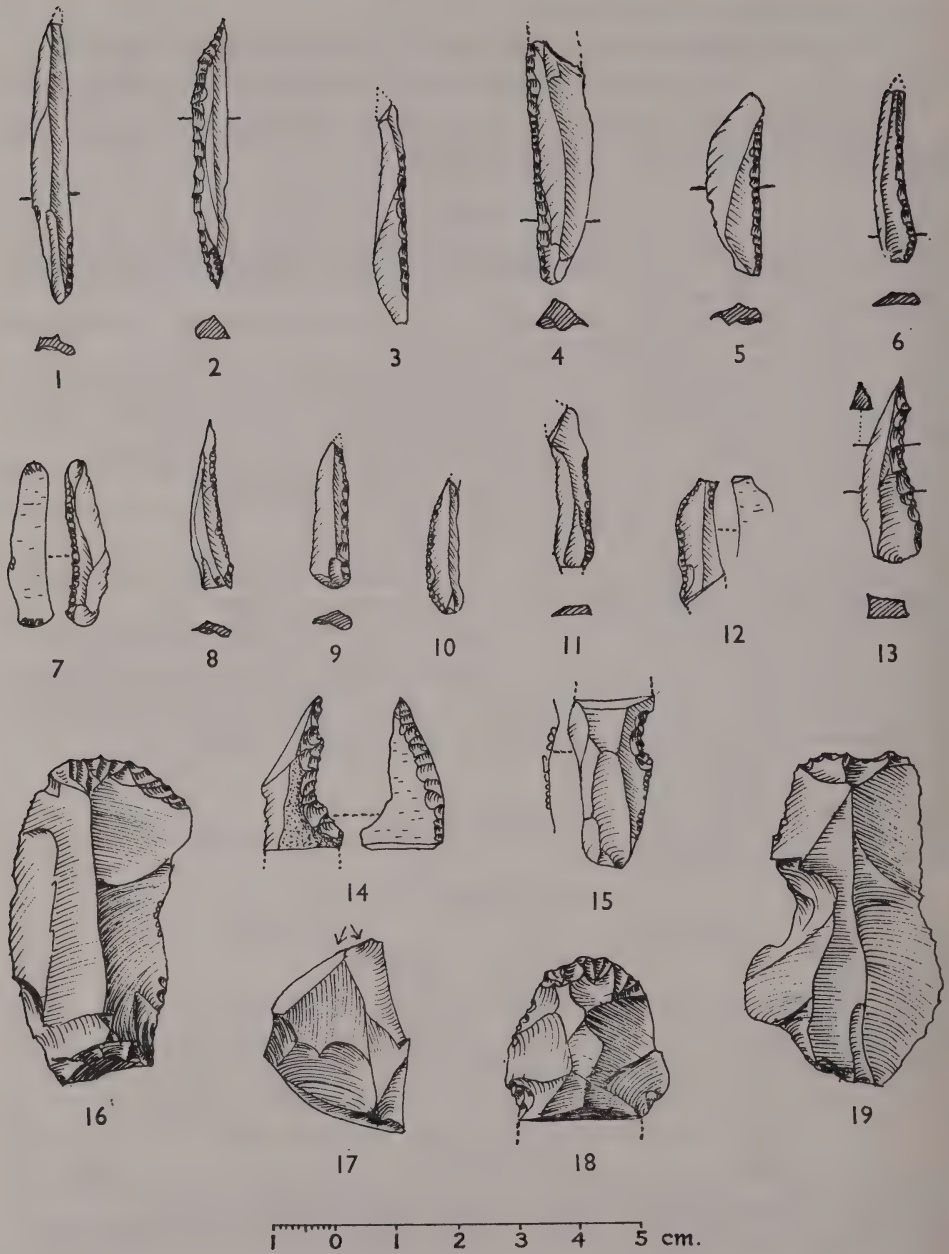


Fig. 2: Abri Bergy, layer V

THE STONE INDUSTRIES OF ABRI BERGY, LEBANON

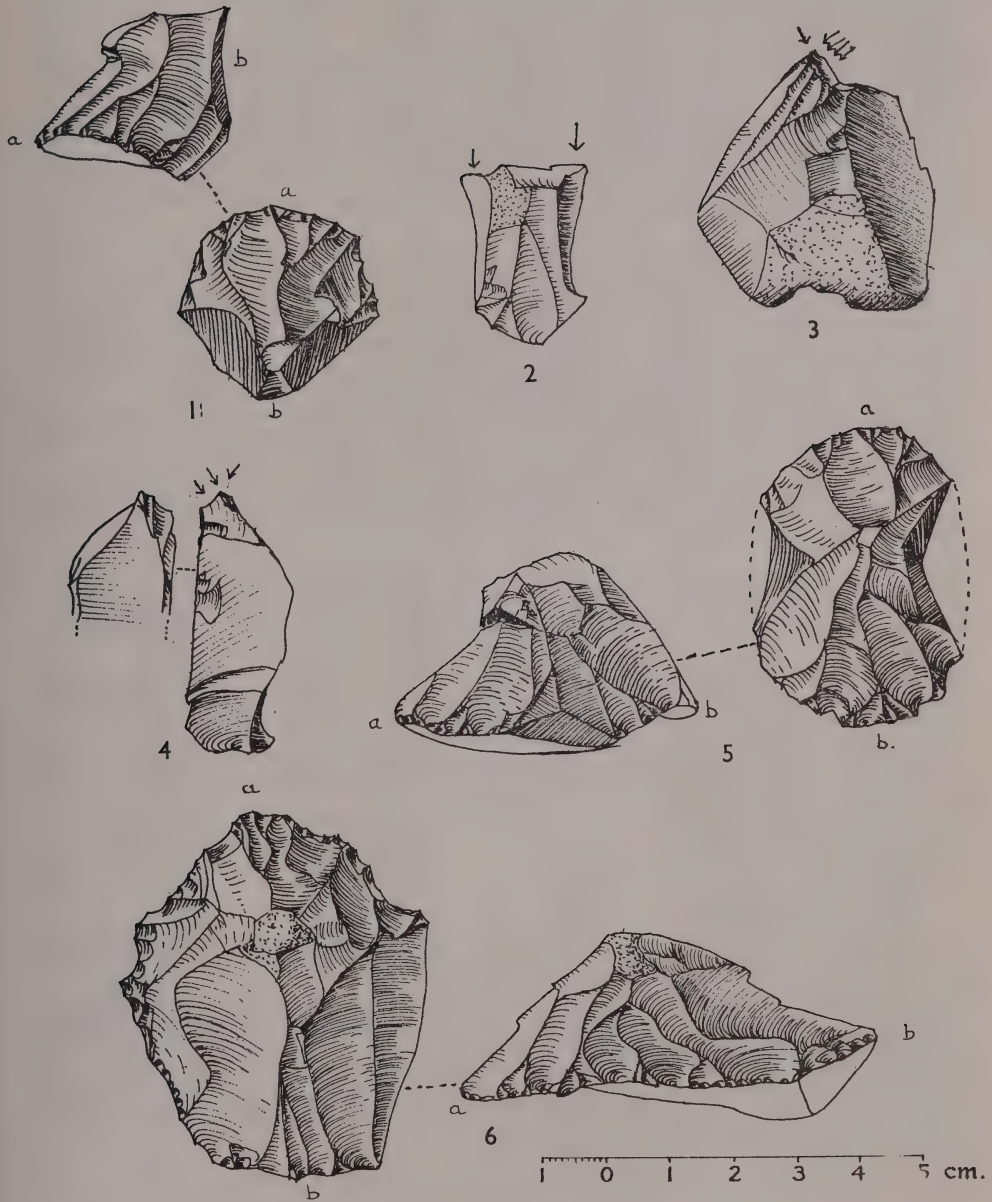


Fig. 3: Abri Bergy, layer V

should be placed more appropriately with the rectangles. Although both examples from this level are incomplete, the specimens from the higher levels clearly indicate their form. They are made on small parallel-sided blades with steep retouch up the back and across the truncations. The angles are nearly right-angles. The fourth, unretouched side, shows signs of use.

Blades with oblique truncation. Two (Fig. 4, 5). In this group the blades are not parallel-sided but are narrower at one end. In the illustrated specimen the truncation is on the base; the retouch on the back and across the truncation is bold and steep, though finer than on the typical Kebarah points. The second is unusually large, with very heavy blunting retouch towards the tip. The lower part of the back is naturally blunted. There are marked signs of use on the edges of both.

Blades with concave transverse truncation. Two (Fig. 4, 20; Fig. 5, 9.) The first is an irregular blade with a slightly concave truncation. The second is a flake rather than a blade; here the concavity is more pronounced.

Blades with oblique concave truncation. One (Fig. 4, 6). This is the 'truncature concave', No. 62 of de Sonneville-Bordes and Perrot, though the Abri Bergy example is much smaller than the type specimen in the Lexique, which is Perigordian. The retouch up the back and across the truncation is fine; the base is missing. This type is of considerable interest when compared with 6, which appears to be a broken example of the same implement. While not necessarily accounting for all the microburins from industries of this period, the many examples broken at the tip against what appears to be a notch, are probably broken specimens of these obliquely truncated blades.

Backed Blades. Twenty-one (Fig. 4, 8-19). These, like the previous examples, are small blades with retouch up the back; the retouch is finer than in the Kebarah points. 14 has retouch on both edges.

Retouched Blades. Four. These are broken blades with slight retouch on part of the back.

End-scrapers on blades. Twenty-five (Fig. 4, 21, 23-26; Fig. 6, 1, 3-5). On the whole these are quite well made, the length and size of the blades varying considerably. While the majority are round-ended, a few are straight. 5, although resembling a truncated blade, was clearly intended and used as an end-scraper.

End-scrapers on Flakes. Nine (Fig. 5, 5-7, 10; Fig. 6, 2). The retouch is quite well made though the flakes are thick and rather irregular. Fig. 5, 5 is very small, and although broken, is comparable in size to specimens from the Kebaran levels at Ksar 'Akil. Fig. 6, 2 has a markedly denticulated edge and Fig. 5, 6 has retouch down the sides, an unusual feature in this context.

Steep end-scrapers. Two. These are end-scrapers made on very thick flakes.

Steep-scrapers. Seventeen (Fig. 6, 6, 7). This is a very poor group being little more than thick chunks with retouch on various corners. In these late industries this type of scraper appears to be in a decline and its functions become increasingly usurped by the core-scrapers.

Core-scrapers. Fourteen (Fig. 5, 8). All are single-ended prismatic cores with the working edge made by removing the ends of the *arrêts* of the blade scars. 8 is a particularly small example.

Burins. Forty-two. (Fig 5, 2-4).

Oblique angle, concave	1	Flat	5
Bec-de-flûte	7	Transverse	4
Faceted ordinary	5	Lateral	1
Single-blow transverse	3	Prismatic	2
Single-blow oblique	6	Polyhedral	8

The transverse burins are those with one facet across the end meeting a facet down the side; the lateral burin consists of one facet across the end.

Chamfered Blades. One (Fig. 6, 9). This is a well-known implement in the early post-Mousterian industries of the Middle East occurring in this context at Abu Halka (the 'chamfreins' of Haller,¹⁰) and at Ksar 'Akil. They consist of blades, the ends of which have been removed by a transverse blow.

Scraper-burins. Six (Fig. 5, 1). These consist of a series of facets across the bulbar face of a flake which meet on a flat surface on the edge; this surface is generally natural and rarely a burin facet. These tools, which are common in the Upper Palaeolithic of the Middle East, are closely related to the narrow steep-scrapers and the polyhedral burins.

¹⁰ Haller, J. 'Notes de préhistoire phénicienne: L'abri d'abou Halka (Tripoli)', *Bull. du Musée de Beirut* 6 (1942). 1-20.

THE STONE INDUSTRIES OF ABRI BERGY, LEBANON

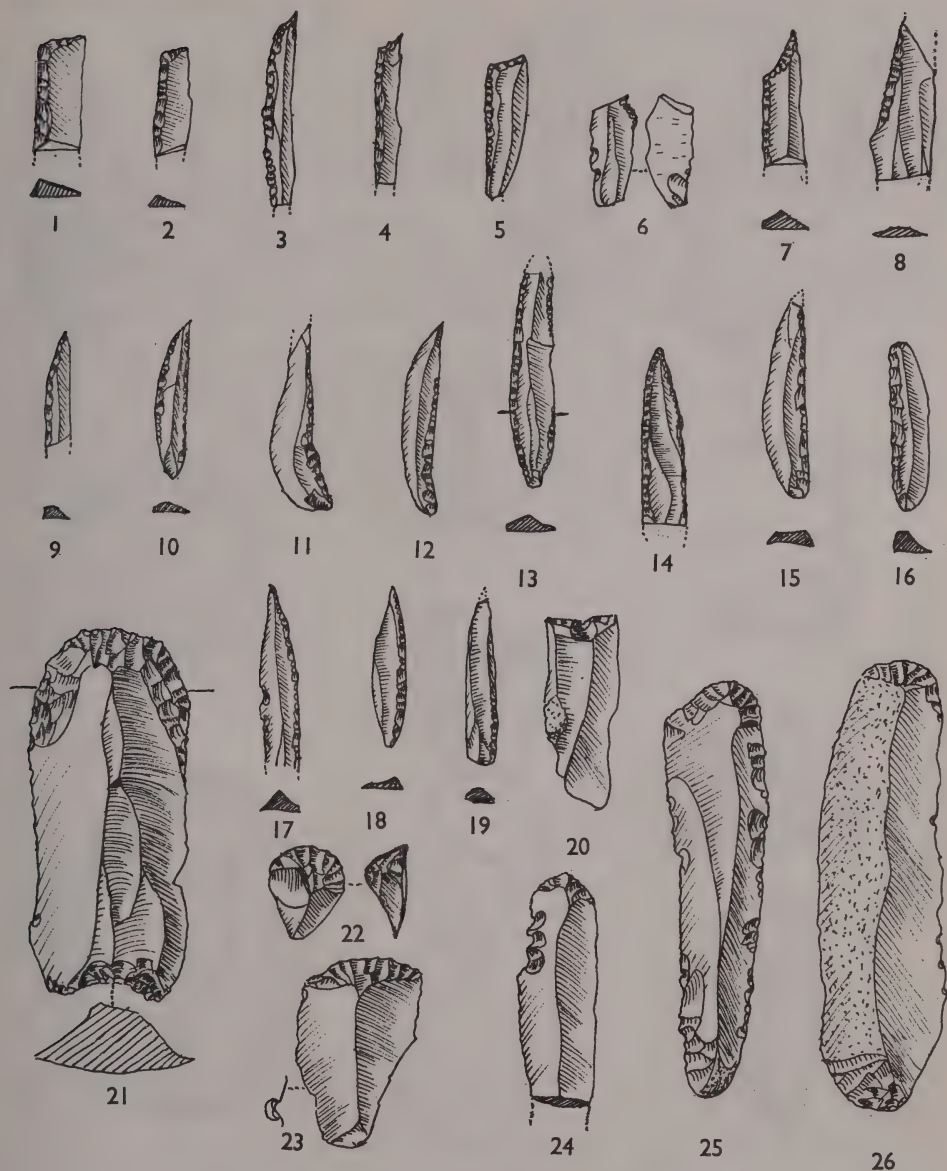


Fig. 4: Abri Bergy, layer IV

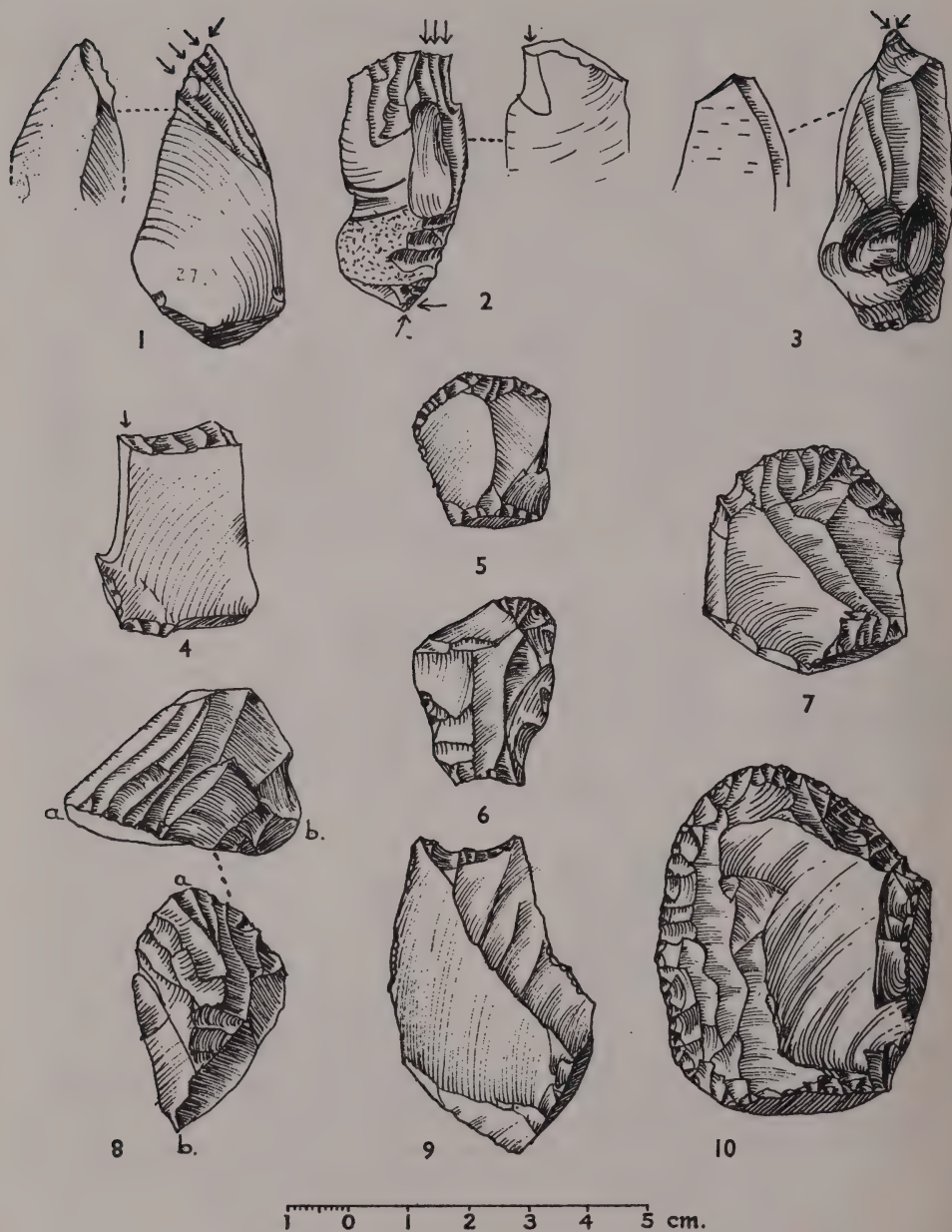


Fig 5: Abri Bergy, layer IV

THE STONE INDUSTRIES OF ABRI BERGY, LEBANON

Blades. One hundred and fifty-one.

Large	Over 7 cm	9	Very small - less than 2.5 cm	4
Medium	4.5-7 cm	41	Broken	42
Small	2.5-4.5 cm	55		
Total				151

The blades are unusual in that there is a higher percentage of large specimens and very few in the very small group. The medium blades are broader and heavier than usual, and one specimen has a prepared striking platform.

Cores. Forty-three: Single-ended prismatic 33
Amorphous 10

All the single-ended cores are small and within the range of the small and very small blades; the working face is generally in one plane though one is almost pyramidal. The amorphous group are nearly circular with flakes struck off at random all around the perimeter, making a very rough disc core.

Notched Flakes. One. A broad flake with a deep, carefully made notch on one side.

Retouched Flakes. Fifteen. These are flakes with retouch on part of the edge.

Re-sharpening-Flakes. Five. These consist of four not very typical guide-flakes and a core-tablet.

Flakes. Thirty-four. No special comment.

Various. Two. One is a flake with a heavily retouched oblique end. The side at the base of the retouch is broken away so that the purpose of the tool is not clear. The second (Fig. 6, 8) is a small bifacial tool suggesting a hand pick. The pointed end is much battered by use.

LAYER IV: INVENTORY

		%			%
Kebarah Points	2	.49	Blades:		
Blades with transverse truncation	2	.49	Large	9	2.24
Blades with oblique truncation	2	.49	Medium	41	10.22
Blades with concave transverse truncation	2	.49	Small	55	13.71
Blades with oblique concave truncation	1	.24	Very small	4	.99
Backed blades	21	5.23	Broken	42	10.47
Retouched blades	4	.99	Cores:		
End scrapers on blades	25	6.23	Single-ended prismatic	33	8.22
End-scrapers on flakes	9	2.24	Amorphous	10	2.49
Steep end-scrapers	2	.49	Notched flakes	1	.24
Steep-scrapers	17	4.23	Retouched flakes	15	3.74
Core-scrapers	14	3.49	Resharpener flakes	5	1.24
Burins	42	10.47	Flakes	34	8.47
Chamfered blades	1	.24	Various	2	1.49
Scraper-burins	6	1.49	Total	401	

LAYER III

Kebarah Points. One (Fig. 7, 1). This is not a very typical example, as the oblique end makes much less of an acute angle with the back, and is much closer to a small curved blade, though the treatment of the retouch is the same as in the Kebarah Points.

Blades with transverse truncation. Nineteen (Fig. 7, 3-9, 12). They are the same as in the previous levels; in some cases they are retouched across both ends; in 12, one end is slightly oblique. Two examples, 7 and 8, have markedly denticulated edges. Four have the corners rounded off and look almost like miniature end-scrapers. 9 is not very typical, being longer and narrower.

Blades with oblique truncation. One (Fig. 7, 2). Excluding the Kebarah point, which is classified separately, there is only one specimen in this group. The oblique end is on the butt, and the retouch fines off towards the pointed end.

Blades with inverse retouch. One. A small blade with slight inverse retouch, extending about a quarter of the way down one edge.

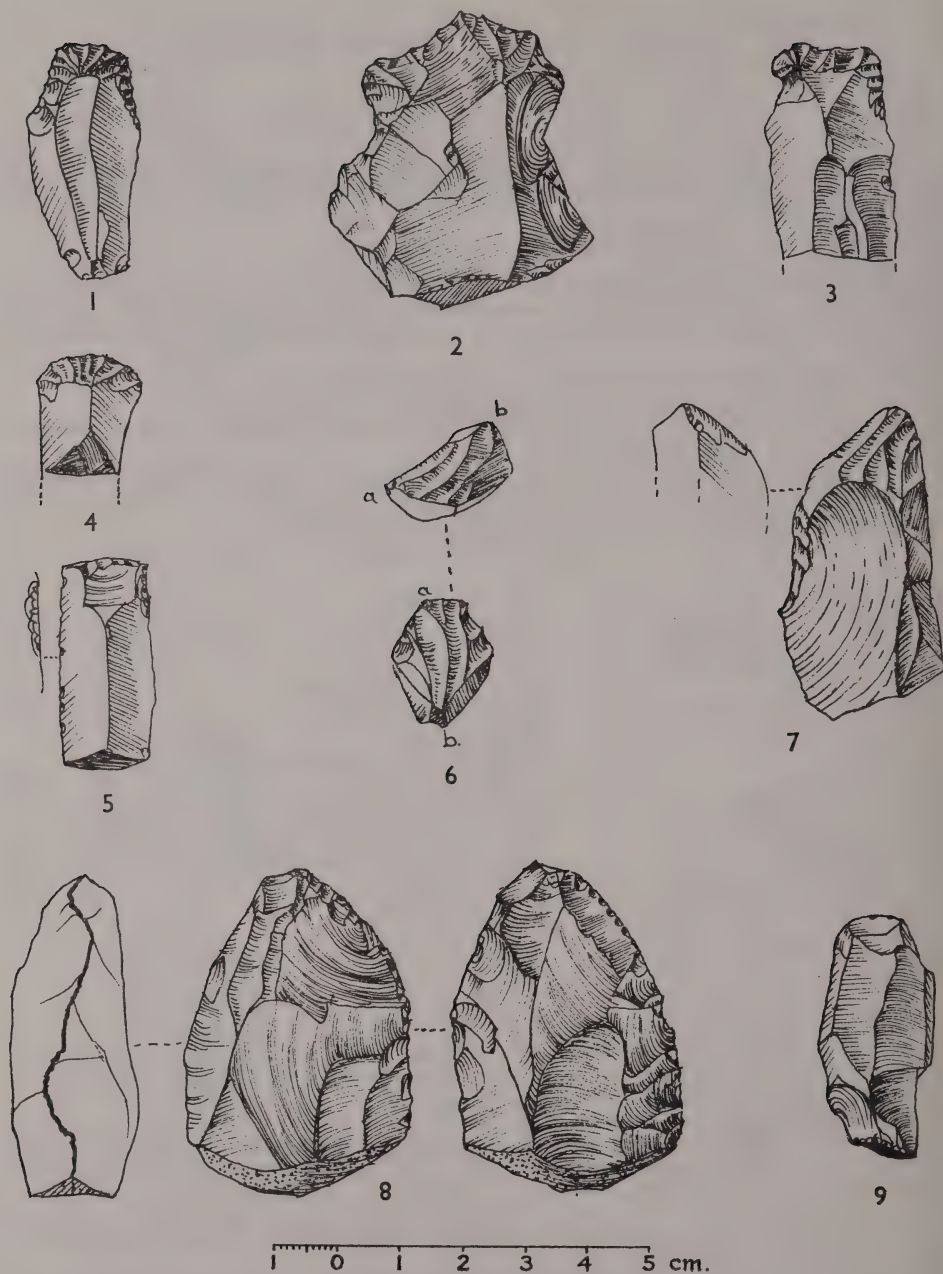


Fig. 6: Abri Bergy, later IV

THE STONE INDUSTRIES OF ABRI BERGY, LEBANON

Backed blades. Nine (Fig. 7, 10). 10 is the only nearly complete specimen, the remainder being only short sections. It is not clear whether these are backed blades or broken truncated blades, as the ends are missing in all cases.

End-scrappers on blades. Thirteen (Fig. 7, 14-16, 18, 19). These are quite neatly made, though the quality of the blades varies from neat specimens like 15-18, to heavy specimens like 14; 15 and 18 are double-ended, though one end is very rough.

End-scrappers on flakes. Four (Fig. 7, 17). These are of medium size, 17 being about the average. The large flake-scrappers and the very small forms are absent, and the flakes are not particularly carefully chosen.

Steep-scrappers. Six. This is a poor and atypical group. Two are made on the back of small cores and the remainder are shapeless lumps with slight retouch on part of the edge.

Burins. Six (Fig. 7, 13)

Oblique angle (13)	2
Single-blow	2
Polyhedral	2

'*Microburins*'. One (Fig. 7, 11). This is the same type as those referred to in the previous level (IV), but in this case it is not snapped obliquely.

<i>Blades.</i> Sixty-six:	Large	6	Very small	0
	Medium	16	Broken	2
	Small	42		

As in the previous level, the blades in the upper range of the medium group are conspicuous. Some of the large specimens are very broad. In view of the small size of the cores, the absence of the very small group could be accounted for by excavator's selection.

Cores. Twenty-one:

Single-ended prismatic	15
Double-ended prismatic	3
Amorphous	3

Nearly all the cores have been modified and fall into the range of core-scrappers, with the ends of the main *arrêts* trimmed away to give a smooth arc. All the single-ended cores are oblique-fronted and small, with the exception of one which is almost pyramidal. The double ended cores have been worked from opposite ends in the same plane. All the cores are small enough to have produced blades in the very small category, i.e. less than 2.5 cm.

Flakes. Two. The absence of flakes, like that of the very small blades, seems to confirm the possibility of selection.

LAYER III: INVENTORY

		%			%
Kebarah Points	1	.66	Blades:		
Blades with transverse truncation	19	12.66	Large	6	4.00
Blades with oblique truncation	1	.66	Medium	16	10.66
Blades with inverse retouch	1	.66	Small	42	28.00
Backed blades	9	6.00	Very small	0	—
End-scrappers on blades	13	8.66	Broken	2	1.33
End-scrappers on flakes	4	2.66	Cores:		
Steep-scrappers	6	4.00	Single-ended	15	10.00
Burins:			Double-ended	3	2.00
Oblique angle	2	1.33	Amorphous	3	2.00
Single-blow	2	1.33	Flakes	2	1.33
Polyhedral	2	1.33			
'Microburins'	1	.66	Total	150	—

LAYER II

Blades with double transverse truncation. Nineteen (Fig. 8, 1-10). In some cases, like 1, 8 and 10, the truncation on the bulbar end is broken. Out of the total, ten are broken.

Backed blades. Four. In three examples the backing is strong, in the fourth rather fine. Since all are only sections, it is possible that the shorter specimens may be broken truncated blades.

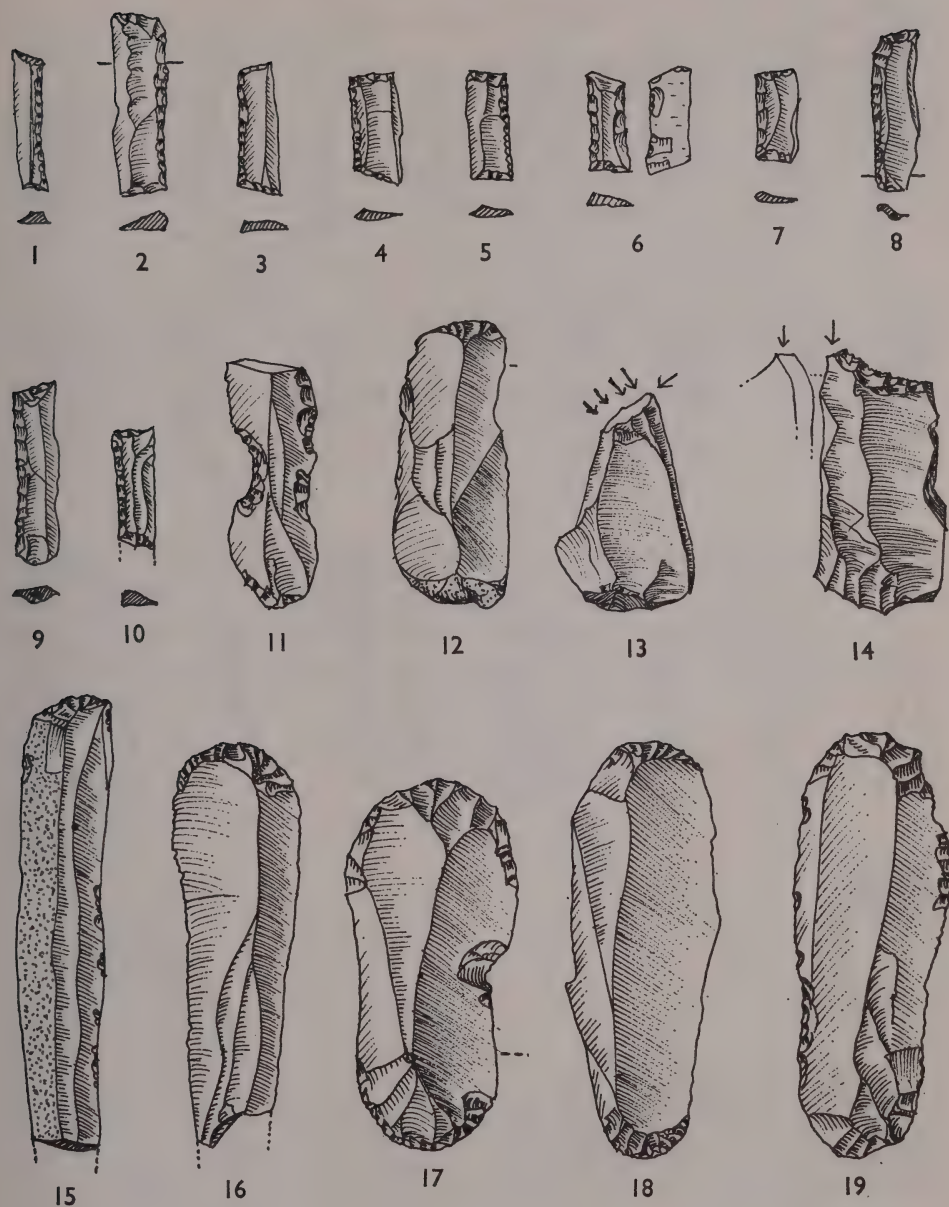
End-scrappers on blades. Twenty. (Fig. 8, 12, 15-19). The examples illustrated are all made on long blades; two, 17 and 18, are double ended. Two have almost straight working edges, and two, made on



1 0 1 2 3 4 5 cm.

Fig. 7: Abri Bergy, layer III

THE STONE INDUSTRIES OF ABRI BERGY, LEBANON



1 0 1 2 3 4 5 cm.

Fig. 9: Abri Bergy, layer II

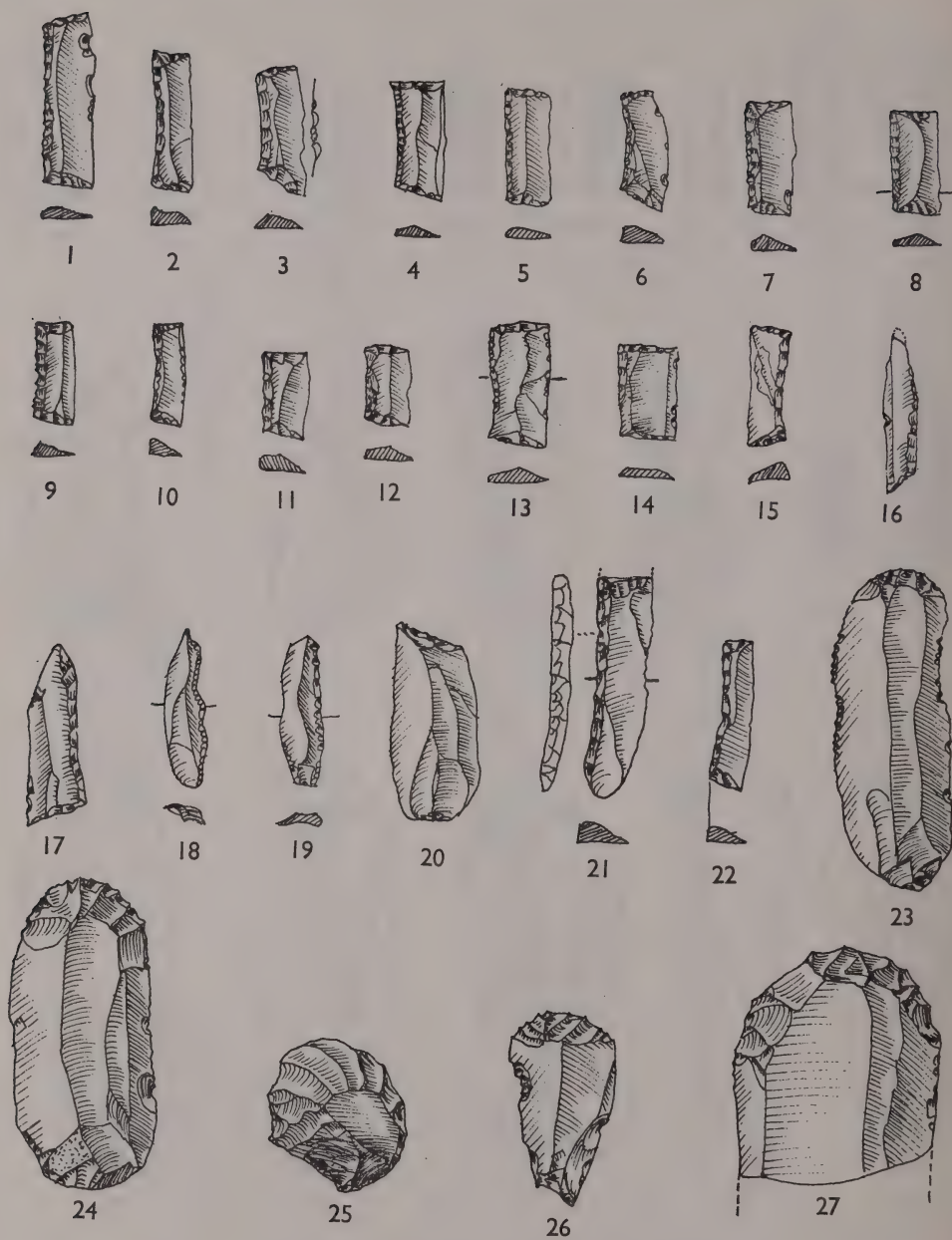


Fig. 8: Abri Bergy, layer II

THE STONE INDUSTRIES OF ABRI BERGY, LEBANON

the ends of broken blades, have the minimum amount of retouch. Three are on narrow blades with a correspondingly narrow working edge.

End-scrapers on flakes. Six. These are quite well made. The slightly denticulated appearance of one is largely due to rough usage. On this specimen there are signs of use on the butt. One example is double-ended.

Steep-scrapers. One. This is a large, domed flake, probably part of a core. Both sides have been extensively used as steep-scrapers.

Burins: Seven

Transverse concave angle	1 (Fig. 8, 14)
Faceted ordinary	1
Bec-de-flûte	1
Single-blow oblique	3
Polyhedral	1 (Fig. 8, 13)

Retouched blades. One. This is a broken blade with slight retouch on one edge.

Notched blades. Five. (Fig. 8, 11). 11 is deeply notched; in the remainder, the notches are smaller and shallower.

Notched flakes. One. An irregular flake with a shallow notch on one edge.

Blades. Sixty-seven.

Large	0
Medium	21
Small	33
Very small	0
Broken	13

Although there are no blades in the large group, there is a high proportion in the upper end of the medium group; as can be seen from Fig. 8, 11-15, medium blades are characteristic. There is also a high proportion of blades in the lower range of the small group.

Cores. Eleven. All are single ended oblique-fronted, and small. The majority have been used as core-scrapers.

Flakes. Seven. One is very large: 7.5 cm. across and very thick. The remainder call for no special comment.

LAYER II: INVENTORY

Blades with transverse truncation	19	12.75	Notched blades	5	3.35
Backed blades	4	2.63	Notched flakes	1	.67
End-scrapers on blades	20	13.42	Blades:		
End-scrapers on flakes	6	4.02	Large	0	—
Steep-scrapers	1	.67	Medium	21	14.09
Burins:			Small	33	22.14
Transverse concave angle	1	.67	Very small	0	—
Faceted Ordinary	1	.67	Broken	13	8.72
Bec-de-flûte	1	.67	Cores	11	7.38
Single-blow oblique	3	2.01	Flakes	7	4.69
Polyhedral	1	.67			
Retouched blades	1	.67	Total	149	

LAYER I

Blades with transverse truncation. Thirty-three (Fig. 9, 1-15, 21 and 22). Eighteen are complete and all are double ended. While the majority are roughly rectangular, some have one end slightly oblique, e.g. 3, 6, and 22. 21 is single-ended, and is more closely related to the following group.

Blades with oblique truncation. Three (Fig. 9, 16, 17 and 20). In 16 and 17 the truncation is on the base, and in 20, at the tip. 16 resembles an oblique Kebarah point, but the retouch along the back is not continuous.

Backed blades. Eight (Fig. 9, 18, 19). Only three are complete; all are small blades with blunting retouch up the greater part of the back. The remainder are only sections.

End-scrapers on blades. Fifteen (Fig. 9, 23, 24, 26, 27). Except for 23 and possibly 26, all are made on large blades similar to those in the layers below. On one, the edge is almost straight, and set obliquely

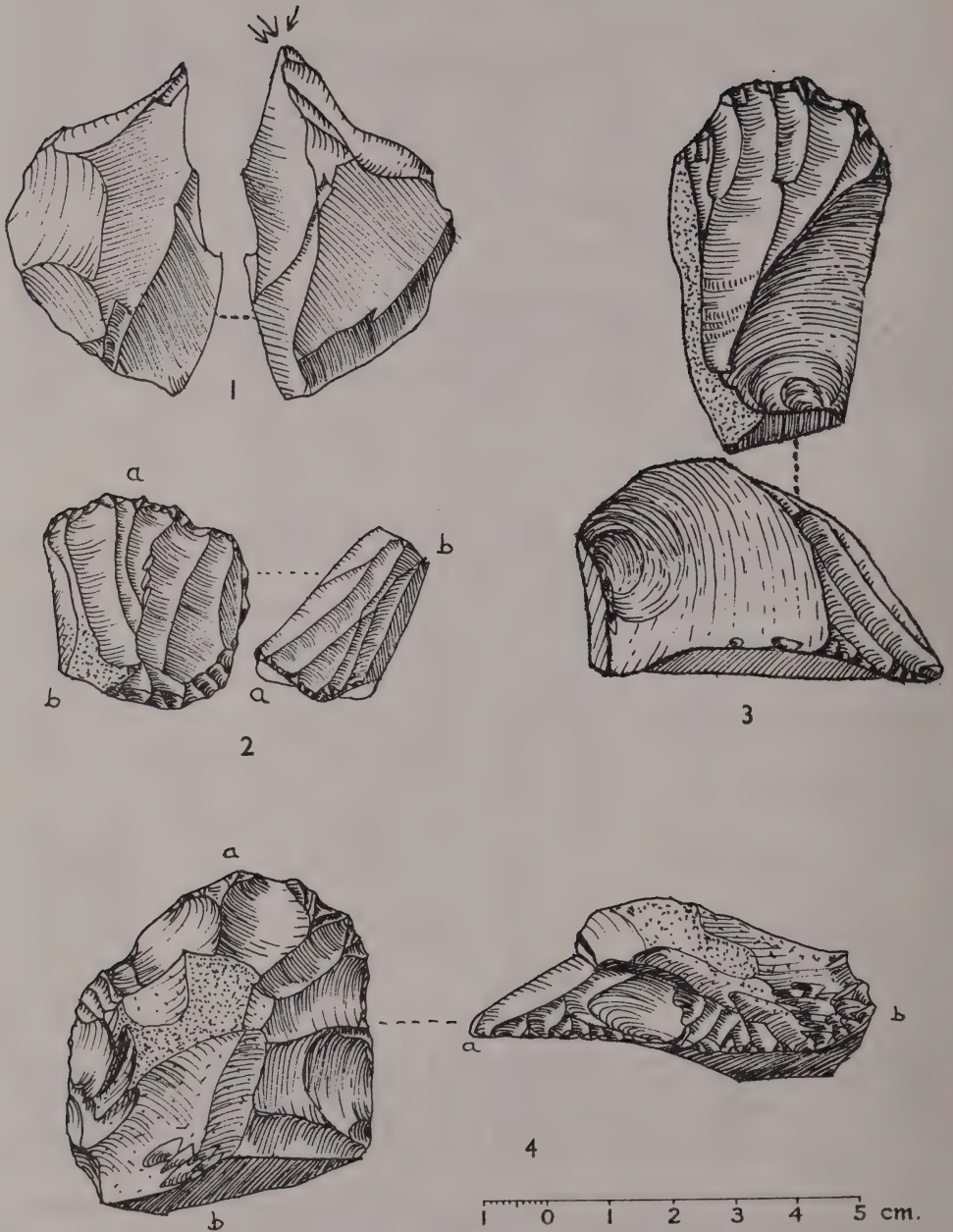


Fig. 10: Abri Bergy, layer I

THE STONE INDUSTRIES OF ABRI BERGY, LEBANON

to the long axis of the blade. One, on a very narrow blade, has a working edge only .8 cm. wide.

End-scrapers on flakes. Two. Both made on short triangular flakes.

Steep-scrapers. Three (Fig. 9, 25; Fig. 10, 4). None is very characteristic nor very well made. 25 is made on a broken pyramidal core.

Burins. Four. This is a very poor group:

Single-blow oblique	1
Faceted ordinary	1
Plane	1
Polyhedric	1

Fig. 10, 1 is a coarse faceted ordinary which could equally well be a small steep-scraper, except that the retouch is on the thickness of the flake and not on the width.

Blades. Forty-one:

Large	0
Medium	18
Small	18
Very small	0
Broken	5

Cores. Twelve. Ten are single ended, and two are globular. In nearly all cases they show signs of modification into core-scrapers. (Fig. 10, 2-3.)

LAYER I: INVENTORY

		%			%
Blades with transverse truncation	33	27.27	Blades:		
Blades with oblique truncation	3	2.47	Large	0	—
Backed blades	8	6.61	Medium	18	14.87
End-scrapers on blades	15	12.39	Small	18	14.87
End-scrapers on flakes	2	1.65	Very small	0	—
Steep-scrapers	3	2.47	Broken	5	4.13
Burins	4	3.30	Cores	12	9.91
			Total	121	

DISCUSSION

The Kebaran industry is now well-defined in the Middle East, both typologically and stratigraphically. At the type-site, Mugharet el Kebarah,¹¹ the Kebaran of Layer C was found between an Aurignacian comparable to Layer D of el-Wad and a Lower Natufian similar to that from el-Wad B.¹²

The material from Layer C of Kebarah bore strong resemblances to the underlying Aurignacian, particularly in the steep-scrapers and the burin forms, and there is good reason to suppose that there is a connection, though not necessarily direct, between them. What does distinguish the Kebaran at Kebarah from both the Aurignacian and the succeeding Natufian is the presence of two groups of 'points'. The first are small backed blades with an oblique end, this being frequently across the base and not the tip. The retouch on the back is bold and the blades are thin and frequently almost scalene in general form. This type, the so-called 'Kebarah Point', is typical of Layer C at Kebarah

¹¹ Turville-Petre, F. 'Excavations in the Mugharet el Kebarah', *Jour. Royal Anthropol. Inst.* 62 (1932), 271-276.

¹² Garrod, D., and Bate, D. *The Stone Age of Mount Carmel I*, Cambridge (1937).

itself.¹³ The second type is pointed at both ends with the same bold retouch up the back, which is frequently slightly concave; and often the point at one end is accentuated by fine retouch on the opposite edge.¹⁴ Both of these forms are equally typical of the Kebaran, though they vary in proportion from site to site, the oblique Kebarah Point being more common at Kebarah and Hayonim and the pointed variety at Ksar 'Akil.¹⁵

The Kebaran is known from a number of sites in the Middle East, and although there are differences in detail between them, the overall picture is the same. In Jordan, two sites have so far been excavated: Wadi Madamagh,¹⁶ and Wadi Dhobai.¹⁷ Both sites produced the same slender backed points, although the typical oblique form is absent in Wadi Dhobai. Unlike Wadi Madamagh and Kebarah, Wadi Dhobai produced two examples of the broad oblique concave blades of Abri Bergy IV (Fig. 4, 6, 7), though at Wadi Dhobai both were broken at the tip. A tool form shared by Wadi Madamagh and Kebarah is the small curved blade tending towards a crescent.

Belonging to this general Kebaran group are the two Nebekian levels and the intervening Spätcapsien found by Rust in Shelter III at Jabrud.¹⁸ In the earlier stage of the Nebekien, Rust's Layers 7 and 6, the small oblique-ended points of Kebarah C type are present, but many of the oblique blades are wider and shorter; there appears to be a localised type with the retouched end curved, rather than at an angle to the back retouch, as in the typical Kebarah point. Rust draws attention to what he refers to as 'micro-burins'.¹⁹ These are more typical than those from Abri Bergy, but in both cases it is difficult to see what purpose they could have served; in the Jabrud examples two have the butt removed and two the tip. In all four cases the waste product, if the term 'micro-burin' is correctly used, forms two-fifths of the total, and these Jabrud specimens appear to be more likely broken tools of the oblique-concave type, rather than by-products. In Rust's Jungeres Nebekien, Layer 4, the wide blades become more characteristic and the retouch across the ends and down the back less well defined.

In the Spätcapsien, between the two Nebekiens, the oblique blades are generally broad as in the later Nebekien and in addition there are small blades with double concave backs. This is broadly the same type as Tixier's 'trapèze

¹³ Turville-Petre, F. *op. cit.* fn. (11), Figs. 17-24.

¹⁴ Turville-Petre, F. *op. cit.* fn. (11), Fig. 25.

¹⁵ Bar Yosef, O. and Tchernov, E., 'Archaeological finds and the fossil faunas of the Natufian and Microlithic industries at Hayonim Cave', *Israel Journal of Zoology*, 15 (1967) p. 104-140.
Ewing, J. F. *op. cit.* fn. (3).

¹⁶ Kirkbride, D. 'A Kebaran Rock Shelter in Wadi Madamagh, near Petra, Jordan', *Man* LVIII (1958), 55.

¹⁷ Waechter, J. and Seton-Williams, V. 'The Excavations at Wadi Dhobai 1937-1938 and the Dhobaian Industry', *Jour. Palestine Oriental Soc.* 18 (1938), 1-23.

¹⁸ Rust, A. *Die Höhlenfunde von Jabrud (Syrien)* Neümunster (1950).

¹⁹ Rust, A. *op. cit.*, Tafel 101, Nos. 63-66.

à deux côtés concave²⁰ though the Jabrud examples are a great deal rougher. Similar forms occur at Ksar 'Akil in a typical Kebaran context.

It has been seen that the various Kebaran industries show certain variations – the tendency towards crescents at Wadi Madamagh, the small thumb scrapers and the high percentage of double-pointed forms of the point at Ksar 'Akil, and the small broad truncated blades from the Jabrud Nebekien. These variations, which may be part regional, part functional, or part chronological, nevertheless indicate that the Kebaran stage to which they all belong is a real phase at the end of the long Upper Palaeolithic development in the Middle East, and it is to this stage that the material from Abri Bergy Layer V belongs.

The upper levels, Abri Bergy IV–I, differ considerably from Level V. The Kebarah C elements disappear and their place is taken by the small double transverse truncated blades. These have been known as a tool-type for many years, being found by Père Bergy in the Lebanese coastal dunes,²¹ in similar positions by Père Buzy (and latterly by Bar Yosef) near Jaffa, and again by Haller at Ash-Ash.²² More recently, attention has been drawn to further material from the Lebanon–Jaita, Neb 'a-al-Mghara²³ and the Beirut Sands.²⁴

Until the excavation of Jabrud the exact stratigraphical position of these industries was unknown, but at Jabrud they clearly followed the Nebekien, which was, as we have already seen, one of the general Kebaran variants. This horizon at Jabrud, Rust's 'Falitien', contains, as well as the double truncated backed blades, some large backed blades (the 'Falita Points') which are not present in this collection from Abri Bergy.²⁵ However, at both sites the Kebaran stage is followed by one with short double truncated backed blades, though those from Jabrud are wider than Abri Bergy.

In connection with these double transverse-truncated blades, a site of considerable importance is that of el-Khiam, in the Judean desert. This site was originally excavated by Neuville early in the thirties and was published by him and Jean Perrot.²⁶ As a result of this and other excavations in the region, Neuville postulated a sixfold division for the Upper Palaeolithic of the Middle East, a system subsequently followed by Clark Howell.²⁷

²⁰ Tixier, J. *Typologie de l'épépaléolithique du Maghreb*, Mémoires du Centre de Recherches Anthrop., Préhist. et Ethnog. de Alger II, 1963, Paris, Fig. 47, Nos. 18–21, type no. 87.

²¹ Bergy, P. *op. cit.* fn. (5).

²² Buzy, D., 'Une station Magdalénienne dans le Négeb', *Révue Biblique* 38 (1929) p. 364
Bar Yosef, O., (personal communication, 1967)

Wetzel, R. and Haller, J. *Le Quaternaire de la région de Tripoli*, Beirut (1945).

²³ Hours, F. 'Rapport Préliminaire sur les fouilles de Jaita', *Bul. Musée de Beyrouth*, 19, (1967); 'Le gisement de Naba'a al Mughara (Liban)', *Acts of the 7th Int. Congr. Pre- and Protohistory*, Prague (1966).

²⁴ Copeland, L. and Wescombe, P. *Inventory of Stone Age Sites in Lebanon*: I (1965), Mélanges Univ. St. Joseph, 41, fasc. 2; II (1966), Mélanges Univ. St. Joseph, 42, fasc. 1.

²⁵ There are some Falita-like blades in Bergy's collection at the University St. Joseph, Beirut, but, since their stratigraphic position is not certain, we may not consider them here.

²⁶ Neuville, R. *et. al.* *Le paléolithique et le mésolithique du désert de Judée*, Archives de l'Inst. Paléont. Humaine 24 (1951), Paris.

²⁷ Howell, C. 'Upper Pleistocene Stratigraphy and Early Man in the Levant', *Proc. of the Amer. Philosoph. Soc.* 103 (1959), 1.

In this scheme, Neuville put the material from Kebarah C and Wadi Dhobai K into his stage VI. This would of course include all the material to which we have given the general name Kebaran. At el-Khiam, Neuville attributed his layer D to his Stage VI, or Kebaran, but the material from this horizon is not typical, lacking the Kebarah Points and the double-ended 'spikey' points. There are, however, double truncated blades, wider than those from Abri Bergy, and with a tendency for the truncations to be oblique. Neuville's el-Khiyam D, in fact, closely resembles Abri Bergy Layer IV.

In 1964, Echegaray published his re-excavation of el-Khiam.²⁸ In this he does not follow Neuville's nomenclature, nor does he wholly agree with the original stratigraphical interpretation. This is not the place to discuss the lower levels, but from Layer 10 to Layer 8, the industries are of considerable interest. Layer 10, Echegaray's 'Aurignaciense Reciente', has a strong microlithic element consisting of narrow backed blades with double truncation, both transverse and oblique, small blades with inverse retouch and small pointed backed blades. Of the larger tools there are rather irregular backed blades, polyhedric burins, rough steep-scrappers and end-scrappers on flakes and blades.

The succeeding Layer 9, 'Atlitiense', differs little from the preceding, but there are a number of heavy guide-flakes and possible micro-burins. Taking these two layers together they contain most of the elements of Neuville's Layer D, Upper Palaeolithic Stage VI. Neither, however, contains the typical ingredients of the Kebaran as known at the type-site and other sites. Echegaray reserves the name 'Kebariense' for the two following levels, 8 and 7, but the material from these is even less typical of the Kebaran; and the combined material of Neuville and Echegaray suggests that there is, in fact, no Kebaran at all at el-Khiam, and that the two 'Kebariense' levels of Echegaray continue the development of the double truncated backed blade industries of Layers 10 and 9, all four levels having strong connections with the material of Abri Bergy IV-I and the other industries with truncated backed blades.

It is becoming increasingly clear that the late Upper Palaeolithic of the Middle East is an unbroken succession of industries derived from the so-called 'Middle-Aurignacian' of el-Wad and similar sites, and that at the end is a very definite stage, the Kebaran, which, though varying from area to area, is nevertheless consistent. On the evidence from Jabrud and Abri Bergy, this Kebaran is followed by industries characterised by small rectangular blades with double transverse truncations, a phase which is equally widespread.

The further development of these industries with truncated blades can be seen in the later levels at el-Khiam. Through three 'Kebariense' stages, the crescents gradually become more pronounced, the micro-burins more charac-

²⁸ Echegaray, J. *Excavaciones en la Terraza de 'el Khiam' (Jordania)*, Bibliotheca Prehistorica Hispana 5, Madrid (1964, 1966).

teristic and the truncated blades longer. In Echegaray's next two stages, 'Khiamiense I and II', the same trends continue, with notch-based projectile points appearing in Stage II: this is the old Natufian IV of Neuville and Perrot. Both of these 'Khiamiense' levels have produced small stone bowls and pestles.

The two final levels are described as 'Proto-Tahuniense' and 'Tahuniense', both with tanged arrowheads; in the later stage these have retouch over the whole of one face. In the final stage are picks, but in neither is there any pottery.

Certainly from the 'Kebariense' levels to the top the development appears to be continuous, and possibly this continuity starts earlier. If this is the case it seems that the typical Kebaran is missing at el-Khiam, and that there is a local development which is to some extent independent of the other regions as far as the end of the Upper Palaeolithic is concerned. In spite of these local differences, the general trends are very similar, all leading towards industries of Natufian type. Although Echegaray denies the existence of a Natufian at el-Khiam, nevertheless his 'Khiamiense' levels are far too close typologically to the Natufian industries as a whole to be dissociated from them, and are surely no more than a local variant responding to different environmental conditions.

Although the graph (Fig. 11) is only tentative it shows certain interesting features suggesting that the development of Kebaran-Abri Bergy-Natufian is borne out to some extent on typological as well as stratigraphical grounds. The sites are listed roughly in stratigraphical order, the Kebaran at the base, those represented by Abri Bergi and related sites in the centre and the Natufian sites at the top. In the Natufian group have been included the later levels from the recent excavations at el Khiam, though the excavators do not consider that this material is Natufian in the generally accepted sense.²⁹ The typological series are also arranged on a stratigraphical basis, the earlier forms to the left and the later to the right.

Although certain forms, particularly in the range of backed blades, occur throughout, there is nevertheless clear grouping of types in the various stages. In the Kebaran the characteristic tools are the two points, one double pointed and the other with an oblique end, generally on the base, both types having heavy steep retouch on the back. In the second group the typical Kebarah points disappear and the emphasis is on small double-truncated blades, a form which is absent in the Kebaran, though Layer IV at Abri Bergy bridges the gap between them. The third group, while retaining the truncated blades adds triangles and crescents, some of the latter with Helwan retouch; a further addition in this group are the backed blades with lustre and finally the arrow-heads.

²⁹ Echegaray, J., *op. cit.* fn. 28.

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The Avifauna of Gorham's Cave, Gibraltar

by ANNE EASTHAM

In the collection from Gorham's Cave Gibraltar there are some 500 bird bones.¹ Amongst them are represented a possible 45 different species. They were found in all levels but there is a marked concentration of numbers in the layers which were also archaeologically prolific, the archaeologically sterile layers having few bones and a very much reduced number of species. Dr. Sutcliffe found a broadly similar pattern in the mammalian fauna, which is also outstandingly rich in species. Waterfowl of all kinds were most numerous in the Mousterian layers K and M, though there were some in layer A. Partridges were found almost exclusively in levels of Mousterian and Upper Palaeolithic occupation. A notable feature is the distribution of the carrion eaters, Griffon Vulture, Kite, Raven and Carrion Crow, whose bones were found only in layers of human occupation.

It is difficult to make any detailed comparison with other sites as there is very little contemporary material, except for that from Devil's Tower Gibraltar, either from the Mediterranean littoral or from continental Europe, which shows a sufficiently wide range of species to be strictly comparable.

Devil's Tower was excavated by Miss Garrod in 1925-6 and the faunal remains identified by Miss Bate.² The nominal check list of bird species is very similar to that of Gorham's Cave and the variations readily enumerated. There seem to have been fewer carrion eaters at Devil's Tower. Miss Bate lists only *Gyps fulvus*; on the other hand there were far more species of Falcon and Booted Eagle, which does not appear at Gorham's Cave. While there were both Cormorant and Shag at Devil's Tower, only Shag was found at Gorham's Cave and, though both sites contained remains of Great Auk, the area round Devil's Tower seems to have been a perching place of Guillemot, while perhaps the colonies local to Gorham's Cave were Little Auk and Puffin, as only bones of these appear in the deposits. It is interesting that on both these sites there were large numbers of both the Common or red-billed Chough and the Alpine Chough. With Kite and Griffon Vulture they were the commonest species after Rock Dove at Gorham's Cave. At the present day the European distribution of

¹ Waechter, Institute of Archaeology, *Bulletin* No. 4 (1964), pp. 189-221.

² *J.R.A.I.* (1928), pp. 33-115.

these two species is horizontally separated in that the alpine form is commonly regarded as a mountain species and the Common Chough remains on lower ground. It is, however, not unusual to find them together in Palaeolithic deposits: they do so at Pech de L'Azé in the Dordogne and at Isturitz in the Pyrenees. From situations like this there arises a deeper question of how far modern patterns of distribution are related to natural variations in environment and how far they have been altered by human agents. This is not the place for such a discussion and in any event it is likely to remain an open question.

The Cotte de Saint Brelade in Jersey should present an Atlantic comparison for the Mousterian levels at Gorham's Cave;³ and though the two sites have few species in common the pattern is similar. As one might expect, the same is not true of the bird fauna from the Mousterian site of Mixnitz in Austria.⁴ Here a fairly typical high forest fauna includes Sparrowhawk, Alpine Chough, Jay, Jackdaw, Magpie, Woodpecker, Nutcracker, Blue-tit and Shrike. This site is dated to the end of the last interglacial of the Alpine sequence and would seem therefore to be contemporary with the lower levels of Gorham's Cave. A further Mousterian faunal comparison may be made with Pech de l'Azé.⁵ The mammalian fauna was dominated by Bos and Horse in all levels and, as at Mixnitz, the bird remains included a large number of passerines, both varieties of Chough, game birds including Quail and birds of prey, Kestrel, Lesser Kestrel, Hobby and an Eagle.

A correlation between Atlantic and Mediterranean avifaunas may be made by comparing both Isturitz and the Grotta Romanelli material with that of Gorham's Cave. At Isturitz there are no birds recorded from the Mousterian levels either of the Grande Salle or the Salle de Saint Martin but a large number of bird bones was found in all levels of Aurignacian industry in the Grande Salle, with a mammalian fauna dominated by Reindeer and Horse. The general picture is again very similar to that of Gorham's Cave: a high proportion of corvines and birds of prey with a number of game birds and waterfowl. In the Grotta Romanelli it is unfortunate that very few bird remains of note were found in the lower levels as there is a considerable list of species which were found in the *terra bruna* layers, and which are dated to the Upper Palaeolithic period so can only be strictly compared to the same levels at Gorham's Cave. A larger number of waterfowl were found and also two species of Bustard, which do not appear on the Gibraltarian sites. Many species, however, including Great Auk are common to both Gorham's Cave and Romanelli and, in both, species of Waterfowl and Divers were found which are not often seen in the Mediterranean today.

³ Marett, 'Site Fauna and Industry of Cotte de Saint Brelade, Jersey,' *Archaeologia* 67 (1915-16), pp. 75-118.

⁴ Abel and Kyrle, *Die Drachenhöhle bei Mixnitz* (Vienna, 1931).

⁵ Bordes, Pech de l'Azé, *L'Anthropologie*, (1955) pp. 1-38.

GORHAM'S CAVE
Summary of
AVIFAUNA

GORHAM'S CAVE Summary of AVIFAUNA		Colymbus stellatus	Procellaria puffinus yelkouan	Phalacrocorax aristotelis	Anas platyrhynchos	Netta rufina	Aythya fuligula	Aythya nyroca	Clangula hyemalis	Melanitta fusca	Tadorna ferruginea	Larus fuscus	Larus argentatus	Larus ridibundus	Alca impennis	Plutus alle	Fratercula arctica	Fulica atra	Ardea sp. purpurea	Ciconia ciconia	Alectoris graeca	Alectoris rufa	Anthropoides virgo?	Haematopus ostralegus	Charadrius sp. cf. dubius	Himantopus ? himantopus	Gyps fulvus	Hieraetus fasciatus	Milvus milvus	Haliaeetus albicilla	Falco peregrinus	Falco tinnunculus	Bubo bubo	Nyctea scandiaca	Strix sp.	Corvus corax	Corvus corone	Corvus monedula	Pyrrhocorax pyrrhocorax	Pyrrhocorax alpinus	Columba livia	Hirundo rustica	Sturnus vulgaris/unicolor	Fringilla coelebs	Emberiza sp.	Turdus viscivorus		
LEVELS	A						2										1	1									1								1			3	2	23			1					
	A2			1													1																															
B	B1		1														1								1	1					3		1					2	1	21			1					
	B2			8																		2						1													20							
D	D1										2	1										1					3		2	1	1			1			2		2	5	12		3	1				
	D2																					2					3		1	1								1	1	4	3	1	2	1				
E																	1					1					5		1										2	1	6					1	1	
F	F1																										2	4	2								2			5	4	12		1				
	2F1.2																		1		2						2	1	2							1			1	14		1						
G				3					1									1		2	3	7					1		6	1	1					1				6	2	33		2			1	
J	J2																																			1			1									
K		1		1		1	3		1		1	1			2	1			1			3		1			5		17					1	1			1	9	4	26							
M				1				1	1	1				1				1					1	2			1		1			1		1	4	1	10	2	20									
N						1																								1									1		1							
P					1													1									3									2	2		2		5							
Q																						1							1										1			2						
R		1		1							1											3					1		3										1		3							
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T																											1		1							1												
TOTALS		2	1	16	5	2	5	1	3	1	1	4	1	1	2	1	4	4	1	3	3	22	1	3	1	1	29	6	42	6	3	3	1	2	2	7	13	3	46	26	199	3	10	3	2		2	

THE AVIFAUNA OF GORHAM'S CAVE, GIBRALTAR

The nominal list of birds, of which remains were found at Gorham's Cave, is given in the order which corresponds to that of Peters' classification⁶ since this makes it more convenient for comparison with other check lists. In the chart, however, this order has been altered and the species have been divided arbitrarily into five groups. The first group includes birds of the water and sea shore; the second contains birds of moor and marsh land, who will also appear on the sea shore; the third includes the birds of prey; the fourth consists of the *Corvidae* and the final group contains Rock Doves as the most numerous species and other small passerines. The purpose of this grouping has been archaeological, since it roughly categorizes species with similar habits and habitat. It should make it easier to see any changes in the bird population, alive or dead, of the area round the cave, which might be accounted for by some alteration in environment brought about perhaps by a variation in climate or human agency.

<i>Colymbus stellatus</i>	Red-throated Diver
<i>Procellaria puffinus</i> ?	Manx Shearwater (East Mediterranean)
<i>Phalacrocorax aristotelis</i>	Shag
<i>Ardea sp. purpurea</i>	Purple Heron
<i>Ciconia ciconia</i>	White Stork
<i>Anas platyrhynchos</i>	Mallard
<i>Netta rufina</i>	Red-crested Pochard
<i>Aythya fuligula</i>	Tufted Duck
<i>Aythya nyroca</i>	Ferruginous Duck
<i>Clangula hyemalis</i>	Long-tailed Duck
<i>Melanitta fusca</i>	Velvet Scoter
<i>Tadorna ferruginea</i>	Ruddy Shelduck
<i>Gyps fulvus</i>	Griffon Vulture
<i>Hieraetus fasciatus</i>	Bonelli's Eagle
<i>Milvus milvus</i>	Red Kite
<i>Haliaeetus albicilla</i>	White-tailed Eagle
<i>Falco peregrinus</i>	Peregrine Falcon
<i>Falco tinnunculus</i>	Kestrel
<i>Alectoris graeca</i>	Rock Partridge
<i>Alectoris rufa</i>	Red-legged Partridge
? <i>Anthropoides virgo</i>	Demoiselle Crane
<i>Fulica atra</i>	Coot
<i>Haematopus ostralegus</i>	Oyster Catcher
<i>Charadrius sp. cf. dubius</i>	Little-ringed Plover
? <i>Himantopus himantopus</i>	Black-winged Stilt
<i>Larus fuscus</i>	Lesser-black-backed Gull
<i>Larus argentatus</i>	Herring Gull
<i>Larus ridibundus</i>	Black-headed Gull
<i>Alca impennis</i>	Great Auk
<i>Plutus alle</i>	Little Auk
<i>Fratercula arctica</i>	Puffin
<i>Columba livia</i>	Rock Dove
<i>Bubo bubo</i>	Eagle Owl
<i>Nyctea scandiaca</i>	Snowy Owl
<i>Strix sp.</i>	Tawny or Ural Owl
<i>Hirundo rustica</i>	Swallow
<i>Corvus corax</i>	Raven
<i>Corvus corone</i>	Carrion Crow
<i>Corvus monedula</i>	Jackdaw
<i>Pyrrhocorax pyrrhocorax</i>	Chough
<i>Pyrrhocorax alpinus</i>	Alpine Chough
<i>Turdus viscivorus</i>	Mistle Thrush
<i>Sturnus unicolor</i> or <i>vulgaris</i>	Starling or Spotless Starling
<i>Fringilla coelebs</i>	Chaffinch
<i>Emberiza sp.</i>	Finch sp.

⁶ Peters, *Birds of the World* (Harvard University Press, 1948 and following).

NOTES ON CERTAIN OF THE SPECIES

Procellaria puffinus ? *yelkouan*

The single humerus from the Upper Palaeolithic Layer B, by which this species is represented, is identical in feature to the humerus of Manx Shearwater but it is too small in comparison with all specimens of the Atlantic form, which were available, and far too large for any other species of Shearwater. The Western Mediterranean form *P.p.mauretanicus* tends to be larger still and it was suggested by Dr. W. R. P. Bourne, who looked at the bone, that it belongs to a member of the Eastern Mediterranean race, *P.p.yelkouan*, which at certain times of year is quite commonly seen in the Straits of Gibraltar at the present day. The measurements of *P.p.yelkouan* as given by R. C. Murphy⁷ support this suggestion.

Ardea sp. purpurea

Although this species is represented only by a fragmentary distal end of tibia, the character of this bone is such that it belongs unmistakably to a member of the Heron family. There is a marked anterior groove running the length of the tibia, which is typical. The determination of Purple Heron has been made on the grounds of size. *Cinerea* is a good deal larger and other European members of the family are considerably smaller.

Anatidae

Remains of Ducks are concentrated in levels M, K and G. Mallard is more widely distributed especially in the lower levels and humeri of Tufted Duck were found in level A. Mallard, Red-crested Pochard, Ferruginous Duck and Ruddy Shelduck are known to breed today in Southern Spain.⁸ The Tufted Duck and the Long-tailed Duck are more of a problem. The Tufted Duck has been known to remain in the Straits all the year round at some seasons and is always common in winter. The Long-tailed Duck is a tundra species and its winter range today only extends southwards into France but it may be in the same case as the Velvet Scoter in Level M. On present day distribution one would anticipate finding Common Scoter, as quite large groups of these are often seen in the Straits in winter, but the size difference between them is considerable and there is no doubt that this is Velvet and not Common Scoter. Miss Bate also found this species in the Mousterian excavations at Devil's Tower Gibraltar but in the report there is no note of its stratigraphical position.⁹ At Isturitz¹⁰ in the Basses Pyrénées Velvet Scoter was found in an Upper Aurignacian layer in the Grande Salle with a fauna otherwise dominated by Horse, Reindeer and Red Deer.

? Anthropoides virgo

The Demoiselle Crane is represented by a single immature humerus from layer M4. The bone is a great deal too small to belong to the Common Crane but, although the Demoiselle Crane is common in Gibraltar at the present day, the other species found with it in this layer makes one query its appearance here on environmental grounds.

Charadrius sp. cf. dubius

A single distal end of humerus in layer B belongs to one of the Plover family. From its size it could be either Little-ringed Plover or Kentish Plover. Both species are known in the area today and the Kentish Plover breeds on the Guadalquivir, just North of Cadiz.

⁷ Murphy, 'The Manx Shearwater as a species of world wide distribution,' *American Museum Novitates* 1586 (September, 1952), pp. 1-21.

⁸ Witherby, Jourdain, Ticehurst and Tucker, *Handbook of British Birds* (1948).

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⁹ *op. cit.* fn. 2.

¹⁰ R. and S. St. Perier, 'La Grotte d'Isturitz,' *Institut de Paléontologie Humaine*, 25 (1952).

THE AVIFAUNA OF GORHAM'S CAVE, GIBRALTAR

? *Himantopus himantopus*

A femur possibly belonging to the Black-winged Stilt also comes from layer B. The species is common in southern Spain at the present day and it breeds at Guadalquivir; but the bone is somewhat abraded and it is difficult to be certain of a correct determination.

Strigidae

The Owl bones of Gorham's Cave form a particular problem, partly of determination and partly of environment.

Bubo bubo

This species is represented by a single left humerus from layer D1. The bone has been heavily brecciated, which has rather obscured some of the bone and its essentially pneumatic character. The proportions and shape exactly match those of the European Eagle Owl except that there is a growth on the lateral epicondyle at the distal end. These kinds of growths are common on the bones of Owls and are usually explained as the result of irregularities in the diet.

Nyctea scandiaca

One left femur of the Snowy Owl was found in layer M4 and a sacrum in K. Both these bones were clearly identifiable as belonging to Snowy Owl. In the femur there is a very distinct structural difference between the Snowy Owl and all other European Owls of comparable size. The angle between the head of the femur and the shaft is approximately 90°, whereas in all the other species of owl I have used for comparison, this angle is considerably more acute. In consequence, the ridge which runs down the shaft frontally in the Snowy Owl runs from a point towards the neck of the femur and not from the great trochanter as in other Owls and again forms an angle near to 90° rather than the more acute angle of other Owl species. The problem which arises here is that the Snowy Owl is not known in southern Europe today, although northern members of the Owl family tend to irrupt southwards from the Arctic in large numbers every few years.

Bones of the Snowy Owl are fairly common in cave deposits of the Palaeolithic period in France, particularly in the Dordogne. In the Basses Pyrenees it was found at Isturitz with Eagle Owl in the final Magdalenian and Azilian levels and in the Upper Aurignacian levels of the Grande Salle. There is of course also the famous engraving, possibly of Snowy Owls, in the cave of Trois Frères.

Strix sp.

The bones of this species from layers K and 4S1 are entirely characteristic of *Strix aluco*, the Tawny Owl, except that they are much too large in comparison with any specimen which was available. They compared most closely in size with the Ural Owl whose skeletal characters seem very similar to those of the Tawny Owl. The present day distribution of the Ural Owl is east European and Scandinavian, though it is also known in the Alps and in Greece.

Alcidae

Plutus alle and Fratercula arctica

Both Little Auk and Puffin are common today on Mediterranean coasts in winter.

Alca impennis

The Great Auk is represented in level K by a proximal portion of right humerus and a complete left coracoid. The bones are quite unmistakable as belonging to a member of the Auk family and their large size immediately identifies them with the Great Auk. They were compared with a specimen from Funk island off the coast of Newfoundland in the Rothschild Bequest in the British Museum and appeared exactly similar. A quite considerable deposit of pale coloured breccia on the coracoid confuses its apparent size and makes it seem thicker than it is but on close examination it was possible to define the total thickness of the deposit and see the real proportions of the bone.

The Great Auk became extinct as a result of over exploitation on Eldey Island, Iceland, on June 3rd or 4th, 1844 and the species has received a great deal of attention ever since. Breeding colonies were always limited in number during recent history and its distribution confined to the North Atlantic. Symington Grieve¹¹ in 1885 gave a map with the distribution of the Great Auk within a line drawn from the North Cape in Norway to Iceland, Greenland, Newfoundland, south to Boston and then eastwards to Cape Finisterre. Fisher and Lockley,¹² however, suggest that its winter range was similar to that of the Razorbill, which appears today in the Mediterranean at that season.

¹¹ Symington Grieve, *The Great Auk* (Edinburgh, 1885).

Great Auk was found at Devil's Tower and Miss Bate published at the same time the Great Auk bone found on Gibraltar by Busk some time previously, in the 1860s. Great Auk bones were found in the upper levels of the Grotta Romanelli¹³ and at the Cotte de Saint Brelade in Jersey.¹⁴ Furthermore, there is a drawing in the cave of El Pendo near Escovedo Santander of a bird, described as a Penguin by Breuil (1912 and 1952) which is a very close likeness of a Great Auk; even the pose is similar to that in the painting by Audubon.¹⁵ In the post-Palaeolithic period, very large numbers of Great Auk bones have been recovered in kitchen midden sites from France northwards to Denmark and ranging in date from the Neolithic to the twelfth century A.D.

Pyrrhocorax pyrrhocorax and *Pyrrhocorax alpinus*

Remains of both Red-billed and Alpine Chough are common in all levels. There are more bones belonging to the common variety but there is no pattern of distribution and the two species seem to have lived there simultaneously. Both species were found together at Devil's Tower and, as I have mentioned above, this seems to be a common feature of Pleistocene bird faunas.

Sturnus unicolor/vulgaris

There are a number of bones of a species of Starling in various levels. They could be either the Common or the Spotless Starling as both seem to be common in the Straits of Gibraltar. The Spotless Starling is quoted as breeding at the present day at Guadalquivir and Irby¹⁶ described mixed flocks of both species landing on the rock. They appear to be indistinguishable skeletally.

Emberia sp.

It was not possible to define to which member of the Finch family the remains in this group belong because sufficient comparative material was not available for this genus. The bones are too large for Chaffinch, Cirl Bunting or Ortolan and I would suggest that they might belong to Corn Bunting, *Emberiza calandra*, which is a regular visitor today to Guadalquivir and breeds in the Camargue.

The most interesting aspect of the avifauna at Gorham's Cave is the coincidence of the human occupation and the occurrence of wildfowl species of both migratory and non-migratory habit. In these levels mollusca commonly eaten by all the wildfowl species were found too. Neither Mallard, Shellduck, nor the Pochard family are truly seasonal, though the *Aythya* species tend to southerly movement in Winter. But the Long Tailed Duck and Velvet Scoter migrate, moving South by sea in Winter and returning to quiet inland Northern waters or moorland to breed. Their presence on Gibraltar suggests that at periods of low sea level the cave was occupied during the late Autumn or early Winter months, possibly to exploit this source of food as it arrived on the shallow feeding grounds offshore.

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¹² Fisher and Lockley, *Sea Birds* (Collins, 1954).

¹³ G. A. Blanc, 'Grotta Romanelli,' *Archivo per l'Antropologie é Etnologia*, L (1921), pp. 14-15.

¹⁴ Marett, *loc. cit.* fn. 3.

¹⁵ J. J. Audubon, *Original water colour Paintings* (Michael Joseph, 1966).

¹⁶ Irby, *Ornithology of the Straits of Gibraltar* (1895).

The Bronze Age of the U.S.S.R.

(A Guide to the Recent Literature on the Subject)*

by T. Sulimirski

In my first report on recent archaeological literature of the U.S.S.R.¹ I concentrated mainly on the Neolithic of Eastern Europe, covering the fourth and third millennia B.C. In this second article of the series, I propose to give a similar account of the literature concerned with the Bronze Age, during the second millennium B.C., which appeared during the last decade, approximately from 1957 to 1967. As previously, of necessity only books, pamphlets and important articles in periodicals available in London were taken into consideration. They have been dealt with in the same way, first publications of a more general character; then consecutively those relating to the many regions of the USSR, starting from the south-western part of the territory.

* In this article the following are the chief abbreviations used:

- AE: *Arkheologiya i Estestvenye Nauki*, Moscow 1965.
AF: *Issledovaniya po Arkheologii SSSR* (Artamonov Festschrift), Leningrad 1961.
AK: *Arkheologiya*, Kiev (in Ukrainian, mostly with a short summary in Russian).
AO: *Arkheologicheskiye Otkritiya*, Moscow 1966 and 1967.
AP: *Arkheologichni Pamyatky USSR*, Kiev (in Ukrainian, mostly with a short summary in Russian).
ASE: *Arkheologicheskii Sbornik*, Hermitage, Leningrad.
JMV: *Jahresschrift f. mitteldeutsche Vorgeschichte*, Halle.
KSAMO: *Kratkie Soobshcheniya Arkheologicheskogo Muzeya*, Odessa.
KSIK: *Kratkie Soobshcheniya Instituta Arkheologii*, Kiev.
KSIAM: *Kratkie Soobshcheniya Instituta Arkheologii AN SSSR*, Moscow.
KSIIMK: *Kratkie Soobshcheniya Instituta Materialnoy Kultury*, Moscow.
MDAPV: *Materialy i Doslzhdeniya z Arkheologii Prykarpattya i Volyni*, Kiev (in Ukrainian, mostly with a short summary in Russian).
MIA: *Materialy i Issledovaniya po Arkheologii SSSR*, Moscow-Leningrad.
MKE: *Materialy Khorezmskoy Expeditsii*, Moscow.
NSA: *Novoe v Sovetskoi Arkheologii* (MIA 130), Moscow 1965.
PEB: *Pamyatniki Epokhi Bronzy Iuga Evropeyskoy Chasti SSSR* (Terenzhkin Festschrift) Kiev 1967.
SA: *Sovetskaya Arkheologiya*, Moscow.
SAS: *Sibirskii Arkheologicheskii Sbornik*, Novosibirsk.
SE: *Sovetskaya Etnografiya*, Moscow.
SVOD: *Svod Arkheologicheskikh Istochnikov. Arkheologiya SSSR*, Moscow-Leningrad.
TIIAEK: *Trudy Instituta Istorii, Arkheologii i Etnografii Akademii Nauk Kazakhstanskoy SSR*, Alma-Ata.
WZH: *Wissenschaftliche Zft der Martin-Luther Universität*, Halle.

¹ *Bulletin* No. 6 of the Institute of Archaeology for 1966, pp. 94 – 129.

In my first article, the 'Neolithic' literature was dealt with, but in several instances also conditions during the first half of the second millennium were discussed. This relates especially to the northern, but also partly to the eastern regions of Eastern Europe where the Neolithic lasted deep into the second millennium and, the local cultures showing almost no changes, the distinction between the earlier remains and those of the second millennium could not be maintained. We shall not return here to the description of these.

I may add that recently (*SA* 1966(4), pp. 240-276) a list appeared of all authors and a classified list of all articles published in *SA* during the ten years from 1957 to 1967. Bibliography for the years 1821 to 1956 (592 items) relating to the archaeology and ancient history of Syr-Daria and Semirechie (the country east of the Sea of Balkhash) has been published by E. I. Ageeva and T. N. Zadneprovskii in *TIIAEK* vol. 7, 1959, pp. 270-307.

Publications of a general character

I have to refer to my first article for a series of publications of a general character in which also topics have been dealt with relating to the second millennium B.C. To them should be added the large work *Arkheologiya Ukrainy* (*Archaeology of the Ukraine*, Toronto 1961, 789 pages, with summaries in English and German) by Ya. Pasternak, formerly Director of the Ukrainian Shevchenko Museum in Lwów (Lviv): by an oversight, it was omitted from my first article. It is based on the collective work of several authors, quoted in my first report, published in Kiev, *Narysy Starodavnoi Istorii Ukrainskoi R.S.R.* (*Essays on the Ancient History of the Ukrainian SSR*), and reproduces most of its illustrations and maps. The book contains, however, some new material, in particular that found in the western part of the area which was Polish before the last war, which was only scantily dealt with in the Kiev volume; furthermore, some of the problems involved have been differently approached.

Only a few books of a general character have appeared since the publication of my first article. One of these is *Istoriya SSSR (History of the USSR)*, or more exactly, the first volume of this publication, in 12 volumes, entitled *Pervobytnoobshchinniyi sroy; Drevneishie gosudarstva Zakavkazya i Srednei Azii; Drevnyaya Rus do nachala XIII v.* (*The Primitive Social Order; Ancient States of Transcaucasia and Central Asia; Ancient (Mediaeval) Russia up to the beginning of the thirteenth century A.D.*, ed. S. A. Pletneva and B. A. Rybakov, Moscow, 1966, 719 pages). The volume is divided into three main parts which correspond with the three parts of its title, each divided into a few chapters and several sections, written by different authors, in all about 30. The book is provided with about 100 illustrations, 20 maps, 3 chronological tables and a large bibliography. Another recent publication is the bulky volume *Bronze Age Cultures in Central and Eastern Europe* (The Hague, 1965, 681 pages, with many illustrations, 115 tables, several maps, etc.) by Marija Gimbutas. This is an

important reference book, although its price (£12) seems rather prohibitive. Another important volume which ought to be mentioned here is *Chronologies in the Old World Archaeology* (ed. R. W. Ehrich, Chicago, 1965). It contains M. Gimbutas' 'Relative Chronology of Neolithic and Chalcolithic Cultures in Eastern Europe North of the Balkan Peninsula and the Black Sea' (pp. 459–506) in which the chronology of East European cultures is discussed.

The work *Finno-Ugry, Balty i Slaviane na Dnepre i Volge* (*Finno-Ugrians, Balts and Slavs on the Dnieper and the Volga*, Moscow–Leningrad, 1966, 308 pages) by P. N. Tretyakov is primarily devoted to the identification of the archaeological cultures of the East European forest zone with the three racial groups quoted in the title and to the study of the reciprocal relations between these groups and of the process of the gradual Slavicisation of large parts of the country. But the book also gives a good review of the main archaeological cultures of the area and of their development from the fourth millennium up to the end of the first millennium A.D. It may also be mentioned in this context, that the question of identification of ethnic (racial) groups and peoples with particular archaeological remains has been discussed by the same author in a special article (*SA* 1962(4), pp. 3–16).

A few volumes, published on special occasions, contain a large number of short articles by different authors. They cover a wide range of subjects and periods, several of which relate to the second millennium B.C. Two of these publications were mentioned in my first article: *Novoe v Sovetskoi Arkheologii* (*New Work in Soviet Archaeology*, Moscow, 1965, 292 pages, *MIA* 130); it contains short articles by 60 authors and is, in fact, a memorial volume to the late S. V. Kiselev. The other, *Arkheologiya i Estestvennye Nauki* (*Archaeology and the Natural Sciences*, Moscow, 1965, 346 pages), consists of articles by 50 authors. In the meantime three other volumes of this type have appeared. One of these, *Arkheologicheskie Otkritiya 1965 goda* (*Archaeological Discoveries during 1966*, Moscow, 1966, 198 pages (paperback)) contains 83 articles by 95 authors, 11 of which, by 14 authors, deal with various topics relating to the Copper and Bronze Ages, mainly during the second millennium B.C. Some of the more important of these contributions are mentioned further below in the relative sections. The same relates to the second greatly enlarged volume of this series, *Arkheologicheskie Otkritiya 1966 goda* (*Archaeological Discoveries during 1967*, Moscow 1967, 350 pages (paperback)). It contains 153 short reports on recent excavations by over 200 authors, arranged in a geographic order of the areas investigated; a large proportion of these deal with the remains of the second millennium B.C. The same character bear the various articles (from among 40 written by 43 authors) in the paperback, *Les Rapports et les Informations des Archéologues de l'URSS* (Moscow, 1966, 268 pages), published in connection with the VIIth International Congress of Prehistoric and Protohistoric Sciences. Unlike a similar volume relating to the VIth

Congress, quoted in my first article, this one was published only in Russian, except for its title.

It should be mentioned also that the cranial material from graves of the Dnieper-Donetz culture has been studied by G. F. Debets (*SA* 1966(1), pp. 14–22) and the results shown in a series of graphs. The author also discusses racial types distinguished in the cranial material of other Neolithic and Early Bronze Age cultures of Eastern Europe. Racial types of the Andronovo culture has been the theme of the article by V. P. Alekseev, 'Antropologiya Andronovskoy Kultury' (*SA* 1967(1), pp. 22–26). The results are shown in three graphs. However, the method applied by the author of comparing the mean-measurements of the cranial material for each group, does not give any picture of the anthropological types included in each of these groups and their differences in this respect. Cranial material from the graves of ancient Chorasmia has been dealt with by T. H. Trofimova in a special issue of *MKE* (*Drevnee naselenie Khoresma po Dannym Paleoantropologii* (*Ancient population of Chorasmia according to findings of Palaeoanthropology*, *MKE* vol. 2, 1959, 176 pages).

A series of books and articles, which deal with topics relating to the development of economy, metallurgy, mining and with the application of scientific methods to archaeological research and to the establishment of a sound chronology, are quoted below under the relevant headings.

Metallurgy and mining

Ancient metallurgical activities and mining in Eastern Europe and Siberia have been studied by several scholars and the results of their investigations published in a series of important articles. One of these, by E. N. Chernykh (*AE* pp. 96–110), was mentioned in my first article. Its enlarged version appeared recently in a special volume, *Istoria Drevneishei Metallurgii Vostochnoi Evropy* (*History of Ancient Metallurgy in Eastern Europe*, Moscow, 1966, *MIA* 132, 144 pages, 39 figures, 14 tables). The same author discusses in the article 'O terminakh 'Metallurgicheskii centr', 'Ochag metallurgii' i drugikh' (The Terms 'Metallurgical Centre', 'Hearth of Metallurgy' and others, *SA* 1967(1), pp. 295–301) the proper meaning of the terms relating to the ancient metallurgy applied in the Soviet archaeological literature. A map on p. 298 shows the larger metallurgical areas within which smaller centres were in existence. Chernykh also produces the results of spectroscopic analysis of copper objects of the Dnieper-Don culture (*KSIAM* 106, 1966, pp. 66–68) and of chemical analysis of the hoard from Borodino in Bessarabia (*SA* 1961(1), pp. 270–272). Its metal composition differed from that of eastern, Seima-Turbino articles; the metal was mostly of Mediterranean origin except for the silver spearhead, which seems to have originated from a metallurgical centre in Eastern Europe, that which produced the silver spearheads found in the Turbino cemetery.

Of particular importance for the study of the development of eastern bronze metallurgy is the work by B. G. Tikhonov, 'Metallicheskie Izdeliya Epokhi Bronzy na Srednem Urale i v Priuralie' ('Metal Articles of the Bronze Age in the Middle Urals and the Country West of the Mountains' *MIA* 90, 1960, pp. 5-115). It is provided with a series of about 20 maps showing the distribution of the main varieties of a series of objects characteristic of the Ural country; a special graph shows the typological and chronological development of these in the area discussed. Another book, *Drevneyshie Metallurgi Priuraliya (The Earliest Metallurgists of the Country West of the Urals)*, Moscow, 1964, 176 pages, profusely illustrated, with four coloured plates) by O. N. Bahder deals mainly with the bronze (copper), silver and other objects excavated in the cemetery of Turbino on the middle Kama, and contains a report of the author's investigation of this burial ground. The author shows a marked tendency to date as high as possible all the metal objects found in the cemetery, and implicitly the cemetery itself, and in this respect is in disagreement with most other scholars.² The beginning of the development of metallurgy in the area further south, on the middle Volga, has been discussed by V. P. Shilov (*MIA* 60, 1959, pp. 11-38), who published the well-known burial of a founder-master of the Srubnaya culture in a barrow-grave at Kalinovka on the Volga. A burial of another founder-master (of the Catacomb culture) has been uncovered south of Volgograd, at Zhutovo on the river Aksan (V. P. Shilov, *KSIAM* 106, 1966, pp. 88-91).³

The beginnings of Caucasian metallurgy, which go back to the turn of the fourth and third millennia B.C., have been discussed by I. R. Selimkhanov (*AE*, pp. 138-145). In Azerbaijan and Dagestan, iron appeared at the beginning of the first millennium B.C., but the earliest iron object found in Eastern Europe is a flat spearhead, or dagger, found in barrow-grave 6 at Bichlin-Buluk near Elista in the Astrakhan steppe country, which is of the Catacomb culture and

² The origin of metal objects from the cemeteries of Seima and Turbino has been discussed recently by E. N. Chernykh in a special article 'Iz Istorii Metallurgii Plemen Epokhi Bronzy v Povolzhie i Priuralie' ('On the History of Metallurgy of the Bronze Age of the Volga and Priuralie Tribes', *PEB*, pp. 195 - 213). The outcome of their spectrographic analysis (shown on five pages) is that they fall into two main groups, an earlier one consisting of objects of eastern, Siberian, origin (objects cast of tin bronze) and the other, larger and of later date, of objects cast of locally smelted copper. The results indicate that the people of both cemeteries were eastern newcomers; they dismiss the thesis of O. N. Bahder of the identity of those buried in the Turbino cemetery with the local population. Both cemeteries dated from about the fourteenth-thirteenth century B.C.

³ A larger study of the 'Cimmerian' bronze industry of the Ukraine has recently been published by A. M. Leskov (*PEB* 1967, pp. 143 - 178). In establishing his chronology of the subsequent stages in the development of the industry, the author shows a marked tendency towards relying on inflated dates proposed for Borodino, Turbino and similar finds (O. Bahder) and disallows accordingly the well-founded chronology of the Srubnaya advance into the Ukraine (the thirteenth century, not the fifteenth, as maintained by the author). This results in a distorted picture of the turn of events in the Ukraine in the second half of the second millennium B.C. The technical process of casting and of making moulds in the Ukrainian Late Bronze Age has been discussed by T. Chernyakov (*PEB*, pp. 179 - 184), and the properties of the stone used for the manufacture of moulds analyzed by V. P. Petrun (*PEB*, pp. 185 - 194).

dates to the first half of the second millennium B.C.; it was of meteoric iron (B. A. Shramko, L. D. Fomin, L. A. Solntsev, *SA* 1965(4), pp. 199–204).

I. P. Selimkhanov, in special articles (*SA* 1961(1) pp. 265–269; 1962(1), pp. 57–65) describes his improved method of spectroscopic analysis of metal objects, and produces the results obtained by it in analysing a large number of metal objects from Armenia and Azerbaijan, and from the East European forest zone respectively. His method of photometric spectroscopic analysis has also been described by D. V. Numov (*SA* 1961(3), pp. 113–121). A survey with tables of analyses of examination of the composition of Copper and Bronze Age tools and weapons of Georgia is contained in the volume *Studies in Georgian Copper and Bronze Metallurgy* (in Georgian with English and Russian summaries, Tbilisi, 1958, 158 pages, tables in text, 36 plates) by Ts. N. Abesadze, R. A. Bakhtadze, T. A. Dvali and O. M. Japaridze.⁴

An open-cast copper mine of about the mid-second millennium B.C., recently investigated at Pastukhovaya Mountain (2733 m. above sea level) on the river Bolshoi Zelenchuk in north-west Caucasus, has been described by V. K. Kuznetsov (*KSIAM* 108, 1966, pp. 62–67).

The development of the Kazakhstan and Altai metallurgy and of copper and tin mining has been dealt with by several authors. A. K. Maksimova, in her study *Epokha bronzy Vostochnogo Kazakhstana* (*Bronze Age of Eastern Kazakhstan*, *TIIAEK*, 7, 1959) devoted a special chapter (pp. 122 ff.) to it. She quotes several sites in which traces of ancient mining (mainly of copper ore) were found and also sites with remains of primitive furnaces for smelting the metal, and those of ancient foundry workshops with a variety of moulds. They all concentrate east of Semipalatinsk, in the valley of the upper Irtysh and on the ridges (Altai, Narymskii, Kalbinskii) on both sides of the valley.

S. S. Chernikov in *Vostochnyi Kazakhstan v Epokhu Bronzy* (*Eastern Kazakhstan in the Bronze Age*, *MIA* 88, 1960, 272 pages, 78 plates, maps) distinguishes four periods in the development of the metallurgy of that area. During the first of these (eighteenth–sixteenth centuries B.C.), North Caucasian types of bronze objects, and those of the Catacomb culture of the Ukraine, were current in west Siberia; the summit of the local metal industry fell into the third period (twelfth–ninth centuries B.C.). Included in the book is also a report of the author's investigation of ancient tin mines in the area east of Semipalatinsk, and the estimated total output of each of these given; the author emphasizes that it was considerably smaller than hitherto maintained. A few changes in the chronological scheme of S. S. Chernikov have been proposed by E. E. Kuzmina (*NSA*, pp. 106–110) in her brief study of bronze hoards from Semirechie, the country east of Lake Balash, south of the area dealt with above and north of Alma-Ata. There was another centre of ancient bronze metallurgy, mainly by the later part of the second and the early first millennia B.C.

⁴ Information and details kindly provided by Professor Stuart Piggott, University of Edinburgh.

The metal industry of the Andronovo culture, and a description of a foundry settlement of the mid-second millennium B.C. in the southern Urals, have also been dealt with by E. E. Kuzmina (*AO* 1966, pp. 84–85). In a larger work, *Metallicheskie Izdeliya Eneolita i Bronzovogo Veka Srednei Azii* (*Metal Objects of the Aeneolithic and Bronze Ages of Central Asia*, *SVOD* B-4-9, 1966), the same author distinguishes three periods in the development of metallurgy in Soviet Central Asia. During the first of these (from the fifth millennium to c. 2000 B.C.) metal objects are found almost exclusively within a restricted area in the southernmost part of Turkmenia, and are mostly of West Asiatic origin. The study is based on the results of spectroscopic analysis of metal objects from 113 sites listed in the volume.

Reports on new investigations of flint mines in the region of Wolkowysk, discovered and examined before the last war by Polish archaeologists, have been given by N. N. Gurina (once jointly with L. G. Kovnurko, *SA* 1964(2), pp. 3–12; *KSIAM* 106, 1966, pp. 31–37). It may be mentioned in this context that two important hoards of flint axes have been published by M. L. Makarevych (*AK* XVI, 1964, pp. 208 ff.), both found at Stina near Vapnyarka, in the region of Vinnitsa in the Ukraine. They jointly consisted of 34 flint axes hidden in two places at a distance of about 500 m. from each other. All the axes were of the same type, made in an evidently post-neolithic technique, of the same variety of whitish flint, most probably of Scandinavian, or north-east German (Rugen?) origin. They testify to a wide trade in flint in the early second millennium B.C., connected undoubtedly with the activities of the bearers of the Globular Amphora culture. Trade in flint was also well developed in the northern areas of Eastern Europe. According to A. V. Anpilogov and K. A. Inina (*SA* 1966(3), pp. 208 ff.), the petrographic study of flints from 'neolithic' sites in Karelia has shown that they originated from the territories of the White Sea and the Kargopol cultures, as well as from the region on the river Kliazma near Moscow.

Methods in archaeological research

G. C. Shtobe (*SA* 1959(4), pp. 135–139) describes the method of chemical analysis of occupation layers (concentrations of phosphorus) which enables the investigators to establish, even in difficult circumstances, the area of ancient dwellings or the extent of ancient settlements. Other scientific methods successfully applied during investigation of remains at ancient Olbia have been described by I. L. Znachko-Iavorskii, Ia. G. Belik and V. T. Illiminskaya (*SA* 1959(4) pp. 140–152), namely chemical analyses, petrographic and mineralogical studies of the stones used for building, of plaster, and of other parts of structures. The technique of the Fatyanovo potters has been studied by P. M. Kozhin (*KSIAM* 101, 1964, pp. 53–58). S. A. Semenov (*SA* 1959(2), pp. 35–46) reports on the results of experimental carving, cutting, chopping and other

ways of working wood with ancient tools. In an article by V. P. Levashova (*KSIIMK* 75, 1959, pp. 46 ff.) the results have been presented of the study of the mechanical properties of ancient tools, stone, copper and bronze shaft-hole axes in particular.

E. A. Rumiantsev (*SA* 1961(1), pp. 236–242) discusses methods of preserving ancient wooden objects. His main subject is the preservation of wooden carts and chariots excavated in burials on Lake Sevan, dealt with further below, and of similar finds in other parts of the USSR, in particular those from the Altai-Pazyryk barrow-graves.

A. L. Mongait (*SA* 1962(1), pp. 16–35) discusses the function and possibilities of archaeological cartography in producing a series of maps showing the diffusion of various prehistoric cultures and finds in Eastern Europe. In addition S. P. Tolstov, B. V. Andrianov and N. I. Igonin (*SA* 1962(1), pp. 3–15) publish the results of aero-survey and photography in Soviet Central Asia, as a result of which several forts and settlements were discovered.

Topics connected with the establishment by scientific methods of a proper and reliable chronology of prehistoric remains have been dealt with by several authors. Several of these methods, and the task and aims of their application, have been briefly reviewed by B. A. Kolchin (*SA* 1963(4), pp. 256–270); the author discusses also metallographic methods for the study of working of metal tools, aerial photography, etc. The dating of archaeological objects by the archaeomagnetic method has been described by S. N. Burlatskaya (*SA* 1962(3), pp. 99–104; 1963(4), pp. 115–121), and by the dendrochronological method by V. E. Rudakov (*SA* 1964(2), pp. 79–88). Results of the pollen analysis of the bottom of a number of graves and huts investigated in the north-east Caucasian area have been published by R. V. Fedorova (*SA* 1959(1), pp. 286–290).

Two articles in *Radiocarbon* 8, 1966, bring the results of Carbon 14 dating of archaeological and geological samples from various parts of the USSR. In the first of these (pp. 292–323), by A. P. Vinogradov, A. L. Devirts, E. I. Dobkina and N. G. Markova, the results given were obtained at the Vernadsky Institute in Moscow. The date, 120 B.C., of charcoal from a 'Neolithic' site on Lake Ushkovskoe, Kamchatka, is of interest, as it implies a great retardment in the cultural development in the north-east of Asia. The other article (pp. 430–441) by I. Liiva, E. Ilves and J. M. Punning, is devoted to the results obtained in the laboratory in Tartu, Estonia, most of which have previously appeared in various publications. It should also be mentioned that S. V. Butomo and Kh. V. Protopopov (*SA* 1959(2), pp. 255–262) are in conflict with the reservations by V. Milojevic relating to the Carbon 14 dating of archaeological remains.

A few articles bring the results of the application of typological method to archaeological research. Thus the division of the East European stone shaft-hole axes ('battle-axes') into several types, and their distribution over eastern

Europe have been published by A. Ia. Briusov and M. P. Zimina (*SVOD B-4-4*, 1966) in a volume with many illustrations and several maps. It may be mentioned in this context that according to E. V. Puzakov (*SA* 1962(1), pp. 268–272), one of the important centres of manufacture of stone shaft-hole axes was the country on the upper Donetz.

K. V. Salnikov (*SA* 1961(2), pp. 37–48) describes the method by which the sequence and relative chronology can be established of various types of pottery excavated, or collected on sites which do not offer any stratigraphic evidence. He illustrates the application of his method to material from sand-dunes investigated east of the southern Urals, by which seven distinct types of potsherds of consecutive cultures have been distinguished, ranging from the third millennium B.C. to the fifth century A.D. Finally, the development of the earliest European bone cheek-pieces from the first half of the second millennium B.C. up to the time of their replacement by specimens cast in bronze in the seventh century B.C., and the problems involved, have been discussed by K. F. Smirnov (*SA* 1961(1), pp. 46–72). The author distinguished several types of the bone cheek-pieces and discussed similar specimens found in other countries, especially in Western Asia and in the Mycenaean world.

Economy, art, beliefs

The development of animal husbandry in the Ukraine has been discussed by O. Lahodovska (*AK XII*, 1961, pp. 16 ff.), according to whom its greatest development began in the *Serednii Stog* period; however, this period has been wrongly dated by her to the beginning of the third millennium, whereas in fact it centred around the turn of the third and second millennia B.C. V. I. Tsalkin (*KSIAM* 101, 1964, pp. 24–30) produced a list of animals identified in the osseous material excavated in settlements and graves of the second millennium B.C. within the huge territory extending eastwards from the Rumanian border up to the territory of the Andronovo culture in west Siberia. Special graphs illustrate the changes in the composition of herds of reared animals during that period and the differences in this respect between the various cultures. P. D. Liberov (*SA* 1959(2), pp. 232–23) describes the find of hens' eggs in a grave of the Catacomb culture at Konstantinovka in the region of Melitopol in the Ukraine, which implies that hens must already have been domesticated then. K. F. Smirnov in a special study, 'Arkheologicheskie dannye o drevnich vsadnikach Povolzhsko-Uralskich stepey' ('Archaeological Data concerning Ancient Horsemen of the Volga-Ural Steppes' *SA* 1961(1), pp. 46–72), points out that the pastoral tribes of the steppe country east of the Volga and of Kazakhstan had already used the horse as a draft animal put to the chariot in the Bronze Age. This is suggested by a relatively large number of cheek-pieces of that period, made of bone and antler, found in this area. A close study by the author of all specimens revealed that the earliest ones, of the fifteenth

and fourteenth centuries B.C., found in graves of the Srubnaya and Andronovo cultures, closely resemble those current at that time in the West Asiatic countries and Iran and Mycenae. Graves in which a pair of horses accompanied the buried chieftain point to the same conclusion. The article by A. M. Leskov may also be mentioned here (*SA* 1964(1), pp. 299–303) describing a pair of cheek-pieces made of antler, found at Trakhtemirove near Kanev in the Ukraine. They were round in shape and represent an early type of the mid-second millennium B.C. The author quotes similar specimens found at Balanbash in Bashkiria and also their Mycenaean analogies.

Clay figurines found at Urup in the north-west Caucasus and also similar ones found in other parts of the northern Caucasus and Transcaucasia, were dealt with by V. I. Markovin (*KSIIMK* 76, 1959, pp. 108 ff.). He points to their connections with similar figurines found in the late Tripolyan sites in the Ukraine and with those excavated in Western Asia, and thinks that the Caucasus played here the rôle of an intermediary.

A study by A. K. Ambroz (*SA* 1965(3), pp. 14–27) is devoted to the sacral signs of the early agriculturalists (rhombs with hooks on their corners), and to their further development and transformations up to the nineteenth century A.D. During these millennia, the signs lost their sacral meaning and became a popular decorative motif.

Anthropomorphic figures and solar signs which appear on pottery and on moulds for casting bronze tools in the settlement of Samus near Tomsk in the central part of western Siberia, and in several other settlements in western Siberia where traces of metallurgical activities were found, have been discussed by M. F. Kosarev (*SA* 1964(1), pp. 292 ff.; *KSIAM* 106, 1966, pp. 27–30). In his opinion, solar signs must have had some ritual or magical meaning and purpose connected with the manufacture of bronze tools and other objects. Solar signs appear also engraved on many slabs of Crimean slab-cist graves of the Catacomb period (mid-second millennium B.C.), mostly in the form of encircled crosses. They were the theme of an article by A. A. Shchepinskii (*SA* 1961(2), pp. 227–231). Another article by the same author (*SA* 1963(3), pp. 38–47) was devoted to the human figures carved in relief on stelae of the Catacomb culture. The meaning of the rock engravings of Kamenna Mohyla near Melitopol in the Ukraine, and especially of the representations of pairs of oxen put to the carts, has been discussed by V. M. Hladylin (*AK* XVI, 1964, pp. 82 ff.). It should be mentioned in this context that all the above engravings from Kamenna Mohyla and the Crimea were described and their chronology and purpose discussed, in a series of articles by A. Häusler (*WZH* 8, 1958, pp. 497–518; 13, 1963, pp. 757–797; *JMV* 48, 1964, pp. 59–82).

A. A. Formozov (*SA* 1962(2), pp. 137–142) deliberates on the meaning of various figures, and especially of the vipers incised on pottery of the Srubnaya culture, which must have been connected with some magical purposes or with

some special set of beliefs. The cult of the feminine deity in Anau, in Soviet Turkestan, from the fifth to the end of the first millennia B.C. has been discussed by V. M. Masson (*KSIIMK* 73, 1959, pp. 14–20); and G. V. Skatskin (*Istoriia Materialnoy Kultury Uzbekistana II*, Tashkent, 1961 pp. 76–91) describes and analyses the petroglyphs found on the Kuraminskii Khrebt (range) of Tian-Shan in the valley of the upper Chadaksay in eastern Uzbekistan. Petroglyphs in two regions north-west of Alma-Ata were published and described by A. G. Medoev ('Naskalnye izobrazheniya gor Tesiktas i Karaungur' *TIIAEK*, vol. 12, 1961 pp. 72–77) and by P. I. Marikovskii ('Naskalnye risunki gor Kuldzhabasy', as above, pp. 78–86). Petroglyphs and paintings on rock on the Angara in east Siberia, have been studied by A. P. Okladnikov in a special book *Petroglify Angary (Petroglyphs of Angara)*, Moscow-Leningrad, 1966). The earliest of these go back to the Bronze Age (second millennium B.C.), whereas the latest ones are of the seventeenth to eighteenth centuries A.D.

The early second millennium in the South-West

The position in this area during the second millennium B.C. differed entirely from that of the earlier periods. Within the Tripolyan territory, which extended over most of the country, a great many small groups appeared, which were mainly of a relatively short duration, being subsequently replaced by new ones. However, in some regions the Tripolye culture survived up to the middle of the second millennium. The literature dealing with this latest, C-1, period of the culture proper, which almost entirely fell in the first half of the second millennium, was quoted in my first article.

A few publications deal with the late Tripolyan hybrid groups, or cultures. Thus the pottery of the Gorodsk culture has been described and discussed by M. M. Shmaglii (*AK* XII, 1961, pp. 20 ff.), who considers the culture to have been a regional group of the genuine Tripolye culture. The extent of this group, or culture, and some problems involved in it have been discussed by the same author in another article (*AK* XX, 1966, pp. 15 ff.). He also turned his attention (*Zapiski Odesskogo Arkheologicheskogo Obshchestva* I (34), 1960, pp. 302–308) to the topographic position of the settlements of the culture and points out that they kept almost exclusively to elevated sites usually surrounded by steep ravines or by meandering streams or rivers. A late settlement of this culture in west Podolia, at Tsviklivtsi near Kamenets Podolskii, was described by T. G. Movsha (*SA* 1964(1), pp. 131–145); a ritual cremation burial was uncovered there.

Burials, mainly slab-cist graves, of the Globular Amphora culture in Volhynia, and early slab-cist graves in the Crimea and the north-west Caucasus, have been briefly described and discussed in a series of articles by A. Häusler (*JMV* 47, 1963, pp. 157–179; 48, 1964, pp. 59–82; 50, 1966, pp. 115–140). He shows that all theories of eastern origin of the Globular Amphora culture are



Map I (for numbered sites see list opposite)

THE BRONZE AGE OF THE U.S.S.R.

1 Komarów	35 Pastukhovaya Mountain
2 Ostrivets	36 Urupskaya
3 Tsviklivtsi	37 Novosvobodnaya
4 Stina	38 Samtavro
5 Olenesti	39 Trialeti group
6 Tudorovo	40 Sites in the country of Kakheti
7 Borodino	41 Mingechaur
8 Sarata	42 Uzerlik Tepe
9 Usatovo	43 Karmir-Blur
10 Olbia	44 Modlona
11 Mykhailivka	45 Yakovlevo
12 Babino	46 Olochino
13 Ushkalka	47 Zolotoruchie
14 Kamenna Mohyla and Konstantinovka	48 Kriushino
15 Seredni Stog	49 Sakhtysh—site on the lake and site Malyi Ostrovok
16 Moshna	50 Kuzmino
17 Sofiivka	51 Lopachi
18 Chervonyi Khutor	52 Mytishchi
19 Strelitsa	53 Sokolskoe
20 Moshka-Khodovichi	54 Serkovo
21 Wołkowysk	55 Vyselki-Bolshoe Kozino
22 Rubtsy	56 Volodary
23 Barrows on the Aksay	57 Chervona Gora—Rusanovo
24 Kalinovka	58 Churachiki
25 Petrov Val	59 Balanovo
26 Rovnoe	60 Khula-Siuch
27 Sosnovaya Maza	61 Urazmanentovo
28 Bichin-Buluk	62 Turbino
29 Kislovodsk	63 Gorbunovo
30 Bamut	64 Beregovskoe
31 Aslanbek-Sheripovo and Gatyn-Kale	65 Arktik
32 Kayakent	66 Novocherkassk
33 Verkhnegunibskoe and Ginchinskii	67 Trakhtemirovka
34 Faskau and Rutkha	

utterly unfounded. A few settlements and burials of the Strzyżów culture, investigated in west Volhynia, were also of the early second millennium. The relative reports were published by Iu. M. Zakharuk (*MDAPV* 3, 1961, pp. 22 ff.), V. D. Baran (*MDAPV* 3, 1961, pp. 151 ff.) and I. K. Sveshnikov (*MDAPV* 4, 1962, pp. 44 ff.; *KSIAM* 85, 1961, pp. 55–65).⁵

It should be mentioned that the middle and upper layers of the stratified settlement of Mykhailivka on the lower Dnieper, discussed in my first article,

⁵ In my recently published work, *Corded Ware and Globular Amphorae North-East of the Carpathians* (Athlone Press, 1968, 213 pages, 57 maps and plans, 35 figures, 24 plates), the reciprocal relations between the several cultures of the Ukraine west of the Dnieper during the first half of the second millennium B.C. have been discussed and their relative chronology established; the settlement of the Mykhailivka has also been considered. The second part of the book is devoted to the reports on the excavation of barrow-graves of the Sub-Carpathian group of Corded Ware and to the description of their contemporary burials and sites in the Ukraine west of the Dnieper, including all slab-cist graves of the Globular Amphora culture.

are of the first half of the second millennium; they have been erroneously dated as of the third millennium B.C. in the report by its investigators, O. F. Lahodovska, O. G. Shaposhnikova and M. L. Makarevych, *Mykhailivske Poselennya* (*The Settlement of Mykhailivka*, Kiev, 1962, in Ukrainian).

Several articles contain reports on the excavation of barrow-graves of the Usatovo culture, with discussion of some topics connected with that culture. A. I. Meliukova (*KSIAM* 88, 1962, pp. 74–82) describes a ‘princely’ Usatovo barrow-grave at Tudorovo in the steppe part of Bessarabia, in which also several secondary graves of later periods were uncovered. The excavation of a barrow-grave at Sarata was described by I. T. Cherniakov (*KSAMO* 1962 (1964), pp. 32–37), and another at Usatovo (no. 13) by E. F. Patokova (*KSAMO* 1961 (1963), pp. 12–16). The excavation of the flat cemetery at Usatovo was published by V. G. Zbenovich (*KSAMO* 1962 (1964), pp. 37–45). Bone and antler tools, ornaments and other objects excavated in the cemeteries and the settlement of Usatovo have been discussed by E. F. Patokova (*Materialy po Arkheologii Severnogo Prichernomoria* IV, Odessa, 1962, pp. 191–194); and Usatovo copper (or bronze) daggers, and those excavated in the cemeteries of the Sofiivka group near Kiev (mainly at Chervonyi Khutor) have been studied by V. H. Zbenovych (*AK* XX, 1966, pp. 38 ff.). The latter author points out that the nearest analogies to the daggers from Usatovo may be found among those of EM II Crete; accordingly, he is inclined to date the relative specimens, and implicitly the settlement of Usatovo, erroneously as c. 2430 B.C. Finally, the results of anthropological study of two male skulls recently excavated in the cemetery of Usatovo were given by G. P. Zinevich (*KSAMO* 1962 (1964), pp. 124–128); their indexes were 75 and 72.

Barrow-graves of the Usatovo type, excavated in the region of Pervomaisk, and the results of the investigation of a few settlements of the Late Tripolyan period, which differed from those of the Usatovo culture, were published by V. D. Rybalova (*ASE* 6, 1964, pp. 79–85). Three barrow-graves of the Bronze Age, of Srubnaya type, excavated at Oloneshty in southern Bessarabia were described by A. I. Meliukova (*KSIAM* 89, 1962, pp. 30–37).

The Bronze Age of the Ukraine west of the Dnieper

The beginning of the Bronze Age in the Ukraine has been usually put at c. 1800 B.C.; survivals of the Tripolye culture and its hybrids have never been mentioned in publications dealing with the Bronze Age of that area. This also relates to a paperback of a semi-popular character, *Bronzovyi Vik na Ukraini* (*The Bronze Age in the Ukraine*, Kiev 1964, 70 pages, in Ukrainian) by S. S. Berezanska. The main emphasis of this useful booklet is on the description of the life and economy, of the material culture, building craft (huts, sepulchral monuments), customs, beliefs, etc., of the Bronze Age inhabitants of the Ukraine, as they are reflected in the actual archaeological material.

An important book is *Predskifskii Period na Dneprovskom Pravoberezhie* (*The Pre-Scythian Period in the Country west of the Dnieper*, Kiev, 1961, 248 pages) by A. I. Terenozhkin. It is devoted chiefly to the Bronze Age cultures of the Ukrainian forest zone, to the Bilohrudivka culture, the main culture of the area west of the Dnieper of the second half of the second millennium B.C., and to its successor, the Chornii-Lis culture of the early first millennium B.C. Some of the theories put forward by the author, especially those relating to the origin, rôle and to some extent the chronology of the Bilohrudivka culture are disputable. They have been censured by V. D. Rybalova (*ASE* 2, 1961, pp. 9–25; *AF* pp. 80 ff.), and by S. S. Berezanska (*AK* XVI, 1964, pp. 49 ff.), who at the same time described the results of her investigation of an ash mound (*zolnik*) near Uman. The chronology of the 'Pre-Scythian period' of the Ukraine (in fact however of the period from the sixteenth to sixth centuries B.C.), was discussed again by A. I. Terenozhkin in a special article (*SA* 1965(1), pp. 63–85); the date of the famous silver hoard from Borodino was dated by him as high as about 1500 B.C., whereas the hoard could not have been hidden before the thirteenth century B.C.

Several smaller reports and articles present the results of investigations of burials and settlements of the Bronze Age in various parts of the area under review. Among these is a contribution by S. S. Berezanskaya (*Materialy po Arkheologii Severnogo Prichernomoria*, 4, Odessa, 1962, pp. 5–15) in which burials (mainly secondary ones in barrow-graves) and settlements have been discussed which yielded pottery of a special type, decorated with several raised bands around the body of the vessels ('mnogovalikovaya' pottery). This pottery appears chiefly in the region on the lower Dnieper and belongs to the late stage of the Middle Bronze Age, the final stage of the Catacomb culture, and the earliest stage of the Srubnaya culture; some authors regard this pottery as a feature characteristic of a distinct culture. A report on the excavation of such a settlement of the late Catacomb period (Babino III), has been published by A. V. Dobrovolskii (*KSIAM* 7, 1957, pp. 40–45); the settlement lay on the river Konka south of Nikopol.

S. S. Berezanska (*AK* XVII, 1965, pp. 170 ff.; XX, 1966, pp. 47 ff.) has also published reports on the investigation of a number of settlements in the valley of the middle Dnieper south of Kiev, which she considers as of the Middle Dnieper culture. The latter culture has been dealt with by I. I. Artemenko (*KSIAM* 93, 1963, pp. 38–48, and recently *MIA* 148, 1967), who in a series of reports relating to his investigations in Byelorussia attributed also to this culture the somewhat similar Byelorussian remains; he considers them to form its 'Dnieper-Desna group' presumably emerging during the second stage in the development of the culture. However, the Dnieper-Desna remains differ from those of the genuine Middle Dnieper culture of the Kiev country, and must be considered as constituting a distinct 'Dnieper-Desna' culture. The relevant reports will be discussed further below.

In the south, in the steppe country west of the Dnieper, the Sabatynivka culture developed during the later part of the second and the early first millennia B.C. Several reports on excavations of settlements and of a few cemeteries have been published by I. M. Sharafutdinova (*AP* X, 1961, pp. 12 ff.; *AK* XVII, 1964, pp. 153 ff.) and A. I. Terenozhkin (*AK* XVI, 1964, pp. 202 ff.). D. Ia. Telegin (*AK* XII, 1961, pp. 3 ff.) published the results of his excavation of the stratified settlements of the culture at Ushkalka on the lower Dnieper. They revealed the incorrect dating of the culture by O. A. Krivtsova-Grakova (*MIA* 46, 1955), and established its proper position in the chronological framework of that part of the Ukraine.

In west Podolia, the most important culture of the developed Bronze Age was that of Komarów, which extended also over northern Bucovina and the north-western part of Bessarabia. Recently a large number of settlements and graves of a similar character, investigated in the Ukrainian forest zone further east, up to the Dnieper (e.g. at Moshna near Cherkassi, V. A. Ilinskaya, *KSIK* 10, 1960, pp. 48–58) have been attributed to the culture.⁶ Relations of the Komarów culture with the Trzciniec culture of the Polish Middle Bronze Age, and with its coeval culture of Rumania, have been discussed by I. K. Sveshnikov (*NSA* pp. 80–92)⁷. The same author, in a recent article, 'Kultura komarowska' ('La culture de Komarów', in Polish with a summary in French, *Archeologia Polski* XII, 1967, pp. 39–107, 16 plates, map) briefly characterized all the remains of the culture, their chronology, stages in its evolution, extent, etc., and discussed the position of the culture in the Bronze Age of the region. The culture has also been dealt with by S. S. Berezanskaya, 'Tshinetsko-Komarovskaya Kultura na Severnoy Ukrainie' ('The Trzciniec-Komarów culture in the northern Ukraine', *SA* 1967(2), pp. 120–136). Finally, some of the problems connected with the Komarów culture, and topics relating to the eastern extent of the 'Hungarian' bronzes of the middle of the second millennium B.C., were discussed by me in a special article (*Bulletin* of the Institute of Archaeology for 1964, pp. 171–188).⁸

Another important culture in the southern part of the region during the second half of the second millennium B.C. was the Noua culture, which spread there from the south, from Rumanian territory. Its northernmost cemetery, uncovered at Ostrivets near Horodenka on the Dniester, has been published by E. A. Balaguri (*MDAPV* 3, 1961, pp. 42 ff.; *AK* XIII, 1961, pp. 145 ff.), who also described the results of his investigation of a settlement of that culture

⁶ For graves on the left bank of the Dnieper west of Chernigov see also S. S. Berezanskaya, (*AO* 1967, pp. 194 – 196).

⁷ He also published (*AO* 1967, pp. 197 – 199) an important barrow grave of the culture excavated recently near Dubno in Volhynia.

⁸ In my book (see *fn.* ⁵) the position of the Komarów culture within the chronological framework established for the country has been discussed and traces of the Trzciniec and Lusitanian influence exercised on the cultures of the second half of the second millennium B.C. in the Ukraine were considered. Its second part included reports on the excavation of all barrow-graves and of other burials of the Komarów culture.

situated near the cemetery (*MDAPV* 5, 1964, pp. 22 ff.). Remains of the Noua culture found in Bessarabia, and the topics connected with them, have been discussed by A. I. Meliukova (*Materialy i Issledovaniya po Arkheologii Iugo-Zapada SSSR i Rumynskoi Narodnoi Respubliki*, Kishinev 1960, pp. 129–149; *MIA* 96, 1961, pp. 6–34).⁹

The country east of the Dnieper

In the forest zone east of the middle Dnieper several smaller cultures had developed during the Middle Bronze Age (second millennium B.C.). One of these was the Marianivka culture in the area east of Kiev, south of the lower Desna; another, the Sosnitsa culture, further east, mainly in the region on the river Seim, a tributary of the Desna. Both cultures were formed by the middle of the millennium under strong influence of the Trzciniec culture, of which it contained many elements. The results of the investigation of several settlements of both cultures, and discussion of their character, their chronology and relations with contemporary cultures in their vicinity, have been the theme of several articles by V. A. Illinska (*AK* X, 1957, pp. 50 ff.; *SA* 1961(1), pp. 20–45), S. S. Berezanska (*AK* XI, 1957, pp. 87 ff.; XII, 1961, pp. 102 ff.; *KSIK* 8, 1959, pp. 80–84; 10, 1960, pp. 36–47), and D. Ia. Telegin (*KSIK* 8, 1959, pp. 72–79; *AK* XIX, 1965, pp. 86 ff.).

The Catacomb culture of the developed Bronze Age was the main one of the steppe country east of the Dnieper up to the Don and partly beyond that river. At about the mid-thirteenth century B.C., it was replaced by the Srubnaya culture which expanded westwards from its original country on the lower Volga. A few settlements of both cultures have been investigated and a considerable number of burials uncovered in barrow-grave cemeteries on both sides of the valley of the lower Dnieper, on the Molochna in the region of Melitopol, in the steppe south of Kherson and also further east up to the lower Don.

Reports relating to the excavations in the valley of the lower Dnieper have been published by thirteen authors in two consecutive volumes of *AP* (IX, 1960 and X, 1961), and by O. A. Krivtsova-Grakova in another publication (*MIA* 115, 1962, pp. 5–55). Graves of both cultures were for the most part secondary burials in ancient mounds, and in particular in those of the Srubnaya culture: they only seldom appeared as the primary ones. One of the authors (O. G. Shaposhnikova, X, pp. 3 ff.) emphasizes that there was no genetic connection between the ancient Yamnaya culture of the lower Dnieper and the

⁹ G. I. Smirnova (*KSIAM* 112, 1967, pp. 66–74) gives a short account of a recently investigated flat cemetery of the culture at Starye Bedrazhi on the Pruth in northern Bessarabia. She considers it to be of the thirteenth century B.C. and one of the earliest of the culture.

Catacomb culture which followed it. One of the reports (M. I. Vyazmitina, X, pp. 64 ff.) describes the investigation of flat cemeteries with stone constructions (stone covers, 'cromlechs').¹⁰

Barrow-graves with some primary, but mainly secondary, burials of the Catacomb and Srubnaya cultures in the region of Melitopol were excavated A. I. Terenozhkin (*AP* VIII, 1960, pp. 6 ff.). A secondary Catacomb burial in an ancient mound (with a stone construction) investigated in the region of Simferopol in the Crimea has been described by Iu. G. Kolosov (*AK* XII, 1961, pp. 119 ff.). Similar Catacomb and Srubnaya burials in mounds excavated in the region on the lower Don were published by A. N. Melentiev (*KSIAM* 103, 1965, pp. 53–57; 106, 1966, pp. 92–98) and V. P. Shilov (*KSIAM* 106, 1966, pp. 88–91); the latter author described a burial on the River Aksay south-west of Volgograd (Stalingrad) of a bronze-smith of the Catacomb culture with moulds and a few other implements.

The results of the excavation of barrow-graves of the Bronze Age near Voronezh on the middle Don were published in a paperback, *Plemena Srednego Dona v Epokhu Bronzy* (*Tribes of the middle Don during the Bronze Age*, Moscow, 1964, 208 pages) by P. D. Liberov. The booklet contains also supplementary contributions by four other authors (pp. 162–205) with brief accounts of the investigation of another cemetery of the same type in that region, and of a series of settlements of the same period. The Bronze Age remains of the area were not uniform, and elements of the Catacomb, Abashevo and Srubnaya cultures have been distinguished. Their reciprocal relations are discussed by the author, who also emphasizes that the region cannot be regarded as the original area of the Abashevo culture as maintained by A. Kh. Khalikov.

A series of articles have been devoted to the results of investigations in the forest-steppe zone further north, in the basin of the upper Don (where several barrow-graves and settlements were excavated: M. E. Foss, *KSIIMK* 75, 1959, pp. 4–16, 17–25; T. B. Popova, *SA* 1961(3), pp. 137–151), and also in the area further west, near Briansk on the middle Desna (F. M. Zavernyaev, *KSIAM* 10, 1960, pp. 65–69; V. A. Padin, *SA* 1963(1), pp. 289 ff.). Elements of the Fatyanovo culture have been found all over the northern part of this country, with those of the Catacomb culture in the south. In the late second

¹⁰ The recently published Festschrift, A. I. Terenozhkin (*PEB*, Kiev, 1967, 218 pages) contains five reports by nine authors on the excavation of 56 barrow graves at several points of the steppe south of Kherson (pp. 20–81). The results have been summarised and the questions relating to the Bronze Age development in the south of the Ukraine dealt with by A. M. Leskov (pp. 7–19). The barrows contained 350 burials, 101 of which were of the Yamnaya culture (over half of the original burials), 40 of the Catacomb culture (only one original burial) and 98 (nine original) of the Srubnaya culture. A large portion of the Yamnaya graves were evidently of the Catacomb period, although this has not been conceded by the author. The author emphasizes that the Catacomb people were intruders who subsequently assimilated their Yamnaya predecessors. The arrival of the Srubnaya people has been wrongly put to about the fifteenth – fourteenth century B.C. In fact, they were forced to abandon their original country on the Volga about 1300 B.C. In the new region they at first still kept to their ancient 'Early Srubnaya' culture, although in their original country a new period then began characterized by a somewhat different Srubnaya – Khvalinsk culture

millennium elements of the Srubnaya culture appeared, and under the impact of the last, the Pozdniakovo culture was formed there (T. B. Popova, *NSA* pp. 132–137; *SA* 1965(1), pp. 154–167). The cultures of the region on the upper Donetz, their chronology and reciprocal relations, have been discussed by E. V. Puzakov (*Materialy po Arkheologii Severnogo Prichernomoria* 4, 1962, pp. 194–202, 6 maps) who in a special graph shows their succession and their position in the chronological framework of the region. An early Srubnaya settlement investigated recently at Rubtsy on the Oskol, near its junction with the Donetz, has been described by S. S. Berezanskaya (*KSIAM* 8, 1959, pp. 85–89).

Topics connected with the Catacomb culture, its origin, regional groups, chronology, etc., have been discussed by L. Klein (*SA* 1961(2), pp. 49–65; 1962(2), pp. 26–38; *AF* pp. 69 ff.). Klein in many points disagrees with the views expressed by T. B. Popova (*Plemena Katakombnoi Kultry* (*Tribes of the Catacomb Culture*, Moscow, 1955, Trudy *GIM*). Of importance also is the article by A. A. Ierusalimskaya (*SA* 1958(2), pp. 34–48), in which graves and other remains of the Catacomb culture in the north Caucasian area and in the steppe country further north, as far as the lower Don, are published, and their division into several successive periods established. The culture survived in that region till about 800 B.C., a few centuries after the disappearance of its main groups in its proper territory between the Don and the Dnieper. Recent excavations, as shown by P. M. Munchaev (*NSA*, pp. 92–96), have revealed the existence of another, hitherto unknown, group of the culture in the steppe extending north of the north-east Caucasus.

The development and relative chronology of the cultures of the Crimean mountains and the steppe country of the third and second millennium B.C., the Yamnaya, Kemi-Oba, Catacomb and Srubnaya cultures, are the theme of a study by A. A. Shchepinskii (*SA* 1966(2), pp. 10–23), the results of which have been produced in a series of graphs.¹¹

The South-East

During the first half of the second millennium B.C., the Poltavka culture developed in the steppe of the lower Volga. Its origin, chronology and its relation to preceding and succeeding cultures, have been discussed by N. K. Kachalova (*ASE* 5, 1962, pp. 31 ff.). She considers the culture to be an independent one, which cannot be regarded as the first stage in the development of the succeeding Srubnaya culture.¹²

¹¹ The same author, jointly with E. N. Cherepanova (*AO* 1967, pp. 179 – 189) gives a brief account of the investigation of barrows in the Crimean steppe and slab-cist graves of the Kemi-Oka culture near Evpatoriya.

¹² In a special article (*KSIAM* 112, 1967, pp. 11 – 22) N. K. Kachalova publishes two graphs which well support her point. They show the association of pottery characteristic of the Yamnaya, Poltavka and Srubnaya cultures with different types of burials and of specific decorative patterns which appear ex-

The gradual advance of settlement into the open steppe on the lower Volga and the region of the Caspian Sea has been studied by V. P. Shilov (*ASE* 6, 1964, pp. 86 ff.). According to this author, the earlier Yamnaya and Poltavka barrow-grave cemeteries kept exclusively to the vicinity of the river valleys, whereas those of the Srubnaya culture (and also those of the later periods) have been found all over the open steppe country. This fact signifies the growing importance of the pastoral economy which by the thirteenth century B.C. became the main, or even the sole, source of subsistence of the inhabitants of the country. A. Kh. Khalikov is concerned with the advance northwards along the Volga of the steppe cultures, those of Poltavka and Srubnaya. He thinks that the Srubnaya culture might have been formed somewhere in the region of Kuibyshev, on the border of the steppe and forest-steppe zones.

Detailed reports on the excavation of larger barrow-grave cemeteries in the steppe country on the lower Volga have been published in two special volumes of *MIA* (60, 1959; 78, 1960) by I. V. Sinitsyn (60, pp. 38–205; 78, pp. 10–168), K. F. Smirnov (60, pp. 206–322; 78, pp. 169–268), V. P. Shilov (60, 323–523).¹³ The primary graves in the mounds were mostly of the Yamnaya culture, but the mounds also contained a larger number (up to 40) of secondary burials, several of these of the Poltavka and Srubnaya cultures. In special articles (*MIA* 78, pp. 282 ff.) the vegetation of the country during the Bronze Age was discussed by A. A. Chigurizeva, and the results of the anthropological study of the osseous material from the cemeteries above were published by N. M. Glazkova and V. P. Chetsov (*MIA* 78), and by V. V. Ginzburg (*MIA* 60). The last author points out that the steppe dwellers of that period were all basically of Europoid stock although of three distinct types, Mediterranean, 'steppe' and 'Andronovo'.¹⁴

Another cemetery in the region, at Rovnoe, was investigated by I. V. Sinitsyn (*KSIAM* 84, 1961, pp. 91–102); 16 mounds were excavated in which 80 burials were uncovered, 35 of these of the Poltavka and Srubnaya cultures.

clusively on pottery of each of the cultures. S. N. Bratchenko (*AO* 1967, pp. 66–69) gives a short preliminary report on the recent investigation of a well planned important stronghold of Livetsovka on the western outskirts of Rostov-on-the-Don, surrounded by a massive well-built stone wall between three and six metres wide. It dated from the middle of the second millenium B.C.

¹³ A report on the excavation of seven further mounds at Bykovo and four at Khutor Stepana Razina nearby was published by N. Ia. Merpert (*PEB*, pp. 82–99).

¹⁴ B. V. Firshtein (*PEB*, pp. 100–140) presents the measurements of 74 skulls from the Yamnaya, Catacomb and Srubnaya burials recently excavated in the Volga and Kalmyk steppes. Their study shows that the Yamnaya population of the area was 'Europoid', dolicho-mesocephalic, but in the Saratov steppe it had a marked brachycephalic admixture. The people of the Yamnaya culture were not all the same racial type within the whole area of its extent. This implies that several different tribes contributed to the formation of the culture. The people of the Catacomb culture on the Volga were basically dolicho-mesocephalic but predominantly dolichocephalic; in some areas west of the Volga, a mesocephalic element has been noted, and in the Kalmyk steppe a brachycephalic admixture was present. The Catacomb people were the only ones at that time among whom cranial deformation was occasionally practised. In the Srubnaya cranial material the dolichocephalic (Mediterranean and 'Europoid' racial types), and the mesobrachycephalic ('Andronovo') elements have been distinguished. The latter penetrated there from the steppe of West Kazakhstan.

Of interest was the north-easternmost barrow-grave of the Catacomb culture investigated by V. A. Fisenko (*SA* 1964(4), pp. 181–185) at Petrov Val on the Volga, about 150 km. north of Volgograd. A short review of the results of the investigation of Poltavka and Srubnaya barrow-graves and settlements on the lower Volga has been provided by N. Ia. Merpert and K. F. Smirnov (*KSIAM* 84, 1961, pp. 3–11). Several barrow-graves were recently investigated further south, on the lower Don, near Novocherkassk; burials of the Yamnaya, Catacomb and Srubnaya cultures were uncovered (A. N. Melentiev, *KSIAM* 106, 1966, pp. 92–98).

Several settlements and barrow-graves of the Bronze Age, chiefly of the Srubnaya culture, were investigated in the region of Kuibyshev on both sides of the Volga, especially around the Samara bend of the river, the border of the steppe and forest-steppe zones. They have been described by A. E. Alikhova (*MIA* 61, 1958, pp. 157–180; 80, 1960, pp. 96–119) and N. V. Trubnikova (*MIA* 61, 1958, pp. 181–202). According to the latter, elements of the Andronovo and Abashevo cultures were found there in settlements of the Srubnaya culture. The development from the third to the early first millennium B.C. in the country on the middle Volga, from the Samara bend northwards to Kazan, has been outlined by N. Ia. Merpert (*MIA* 61, 1958, pp. 45–156), who also discusses the reciprocal relations there between the local Kazan Neolithic and Bronze Age cultures with the advancing Srubnaya culture.

The important bronze hoard of the Srubnaya culture from Sosnovaya Maza has been dealt with by N. Ia. Merpert (*KSIAM* 108, 1966, pp. 132 ff.) who dates it to c. 1300–1100 B.C., and points out its connections with the Caucasian and Luristan bronzes. E. N. Chernykh (*KSIAM* 108, pp. 123–131) presents the results of the chemical analysis of the 63 objects in the Sosnovaya Maza hoard, and comments upon them.

The North Caucasus

The most important publication dealing with the north Caucasian Bronze Age to appear during the period under review is the work, *Kultura Plemen Severnogo Kavkaza v Epokhu Bronzy* (*The culture of the north Caucasus during the Bronze Age*, *MIA* 93, 1963, 152 pages) by V. I. Markovin. The author is of the opinion that the north Caucasian cultures, the Kuban culture in the west, and the Kayakent culture in the east, hitherto considered as distinct cultures, were in fact only regional groups of a single entity, the north Caucasian Bronze Age culture. Nevertheless, he distinguished its three well-discernible groups, the North-Western (formerly called the Kuban culture); the Central, subdivided into two sub-sections, the Piatigorsk-Nalchik and the Highland sections; and the North-Eastern, or the Kayakent-Khorochoi group. Three periods in the development of the North Caucasian culture are recognizable; they covered the whole of the second millennium. During the latter part of the second period,

the territory of the culture shrank considerably; during the last period a gradual transformation took place of the highland section of the Central group into the Digorian culture, the predecessor of the Koban culture of the Early Iron Age. The above work was preceded by a few articles by the same author, in one of which the origin and the formation of the North Caucasian culture were discussed (*SA* 1959(1), pp. 3–20); in another the literature dealing with the Bronze Age of the north Caucasus was reviewed (*SA* 1960(2), pp. 280–284).

Several publications by various authors contain reports on investigations mainly in the north-east Caucasus, the area hitherto rather neglected by archaeological research. One of these is the book, *Drevnosti Checheno-Ingushetii* (*Antiquities of the Checheno-Ingush Country*, Moscow, 1963, 280 pages), which contains seven contributions by six authors. Among these is V. I. Markovin's report on the excavation of a flat cemetery of the mid-second millennium (slab-cists) at Gatyn-Kale, and E. N. Chernykh's publication of the results of his spectroscopic analysis of all metal objects from the cemetery: all were of arsenic bronze. A report on the same cemetery, likewise by V. I. Markovin, appeared previously (*KSIAM* 84, 1961, pp. 49–55) and another (*KSIAM* 88, 1962, pp. 45–50) on the results of the investigation of a settlement of the same period at Aslanbek-Sheripovo, situated close to it. A barrow-grave cemetery at Bamut, in the steppe part of the country has been investigated by R. M. Munchaev and V. I. Iarianidi (*KSIAM* 98, 1964, pp. 90 ff.; 106, 1966, pp. 74 ff.); elements of the Catacomb culture have been found there. Settlements in the north-east Caucasus, including those at Kayakent and Dzhemikent, and also several cemeteries and single graves, have been described by A. P. Kruglov (*MIA* 68, 1958, pp. 7–50).

In a paper back of semi-popular character, *V Uscheliakh Arguna i Fontagi* (*In the Gorges of Argun and Fontaga*, Moscow, 1965, 128 pages), V. I. Markovin gives a short description of the main finds and remains (graves and settlements) investigated in the highland part in the area south of Groznyi, mostly of the Bronze Age, but also of other periods. A study by V. G. Kotovich (*SA* 1965(3), pp. 5–13) is devoted to the development and changes in the economy of the highland part of Dagestan, and to the rôle and reciprocal relation of its agriculture and animal husbandry during the third and second millennia B.C.

Only a few articles have been published relating to Bronze Age remains in other parts of the north Caucasus. A flat cemetery was investigated by V. B. Korolev (*SA* 1962(1), pp. 269 ff.) in the region of Kislovodsk, the western section of the Central group of the North Caucasian culture; elements of the Catacomb culture have been found there.

Remains from the cemeteries of Faskau and Rutcha in the Central Caucasian highland area, of the period preceding the formation of the Koban culture, have been discussed to V. A. Safronov (*KSIAM* 108, 1966, pp. 23–30). The author points to Italian analogies of the period 1200–1100 B.C. for the

brooches found in the cemeteries, shows that a bronze dagger from grave 16 at Rutcha was modelled on an 'Hungarian' prototype, and establishes the date of the cemetery of Rutcha as the twelfth century B.C.

Bronze daggers imported from the south, found in the Caucasus have been studied by M. N. Pogrebova (*KSIAM* 103, 1965, pp. 11–18) who distinguished three main groups. Close analogies to one group may be found in Luristan, and several specimens of Assyrian origin were found in the remains of the Koban culture of the early first millennium B.C.

Transcaucasia

The Colchidic culture which extended over western Georgia and Abkhasia was dealt with in *K Istorii Kolkhidskoy Kultury (On the history of the Colchidic Culture*, Tbilisi, 1965 in Georgian with a Russian summary) by D. L. Koridze. The development of the culture, its chronology, etc., are discussed and its bronze hoards described and the results of the analysis of metal tools and weapons given. The culture was in existence during the period from the eighteenth to the seventh century B.C. It greatly contributed to the formation, by the end of the second millennium, of the Koban culture of the Caucasian highland. The date of the cemetery of Samtavro (further east in Georgia) has been debated by R. M. Abramishvili (*Vestnik Gosudarsvennogo Muzeia Gruzii* XIX–XXI, Tbilisi, 1957, pp. 115–139) according to whom five periods can be distinguished in the use of the cemetery. The lowest level was of the thirteenth to twelfth century B.C., the next of the eleventh to tenth century. The uppermost was of the sixth century B.C. Table II contains a graph showing the main types of graves and grave-goods arranged in a chronological sequence in groups. Another publication of this cemetery, by T. Chubinishvili,¹⁵ *Drevneyshie Arkheologicheskie Pamyatniki g. Mtskheta (The Earliest Archaeological remains of the town of Mtskheta*, in Georgian with Russian summary, 127 pages, 17 figs., 19 plates) contains its description with the material set out by grave-groups. The results of a new excavation (in 1959–1962) of Trialeti barrow-graves in Central Georgia have been summarized by O. M. Djhparidze (*SA* 1964(2), pp. 102–121). A more detailed description of these is given in two contributions by the same author.¹⁶ In the first of these, *Archaeologische Ausgrabungen in Thrialeti in den Jahren 1957–1958* (in Georgian with German summary, Tbilisi, 1960, 51 pages, 23 plates) of special interest is the description of barrow no. 5 in which the pit grave was uncovered with a log roof, and there was a four-wheeled wagon and bronze dagger with reeded midrib. The other one 'Otchet Trialetskoy Arkheologicheskoy Ekspeditsii 1962–63 gg.' ('Report of the Trialeti Archaeological Expedition 1962–63', *Trudy Tbilisi Gosud. Univer-*

¹⁵ Information and details kindly provided by Professor Stuart Piggott, University of Edinburgh.

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siteta, 107, 1964, pp. 65–85, in Georgian with Russian summary) partly repeats the author's paper in *SA* mentioned above, but contains the description of an additional barrow with a rectangular chamber and a dromos approach. The easternmost part of Georgia, the country of Kakheti, has been dealt with in *Drevnyaya Kultura Plemen Naselyavshikh Territoriyu Ioro-Alazanskogo Basseina* (*The Ancient Culture of the Tribes living in the basins of the Iori and the Alazani*, Tbilisi, 1965, in Georgian with a summary in Russian, 150 pages, 30 plates) by K. N. Pitskhelauri. Only a few finds have been recorded of the time prior to the middle of the second millennium B.C. Settlements and graves, including barrow-graves, of the second half of the second millennium and early first millennium have been described and their diffusion shown in two maps (p. V: 1, 2). Finally, *The Georgians* (London, 1966, Ancient Peoples and Places series, Thames and Hudson) by D. M. Lang should also be mentioned. It gives a brief review of the prehistory of Georgia, and of Transcaucasia in general, including the second millennium B.C. which is our main concern here.

Developments in Armenia from the mid-third to the end of the second millennium B.C. have been dealt with in *Armeniya v Epokhu Bronzy i Rannego Zheleza* (*Armenia in the Bronze Age and Early Iron Age*, Erevan, 1964, 312 pages) by A. A. Martirosyan. The chronology of the Armenian Bronze Age and Early Iron Age, and their division into consecutive stages, have been also briefly reviewed by the same author in a special article (*SA* 1964(3), pp. 21–36). He points to connections with Anatolia and Western Asia during the seventeenth to sixteenth centuries B.C. and with Troy and the Mycenaean culture in the sixteenth to fifteenth centuries (Middle Bronze Age). The summit of the Armenian Bronze Age culture began at the turn of the fourteenth and thirteenth centuries and lasted during the subsequent three hundred years; Armenia was then closely linked with the cultures of Western Asia. At that time the earliest iron objects appeared in Armenia: iron pins were found at Karmir-Blur in the pre-Urartian layer dating from c. 1100 B.C. Armenian painted pottery of the middle of the second millennium has been described by T. S. Khachatrian and S. A. Esayan (*SA* 1958(4), pp. 196–198). Of special interest are the results of the excavation of barrow-graves, slab-cists, 'cromlechs', etc., within the area of the recently drained part of Lake Sevan. Well preserved wooden carts with four plain wheels, chariots on spoked wheels, a copper figurine-model of the latter and a large number of other varied objects were found; they are mainly of the thirteenth to twelfth century B.C. Preliminary reports have been published by A. O. Mnatsakanian (*SA* 1957(2), pp. 146 ff.; 1960(2), pp. 139–152; *KSIAM* 85, 1961, pp. 66–72) and by E. V. Khanzadian (*KSIAM* 91, 1962, pp. 66–71).¹⁷ Professor Stuart Piggott very kindly sent me particulars relating to two other

¹⁷ Their short description, by A. Mnatsakanian, also appeared in the *Illustrated London News* (April, 1967). It is worth noting that, according to archaeological evidence, gold was already being mined there in the mid-second millennium.

publications dealing with Armenian remains of the period. The book by T. S. Khachatryan, *Materialnaya kultura drevnego Artika* (*Material Culture of Ancient Artik*, Erevan, 1963, 216 pages, 27 figures, in Russian with Armenian summary) is an illustrated report on the excavation of twenty Catacomb graves at Artik, with rich grave-goods of the period of the Lchashen (Lake Sevan) wagon-graves, mentioned above, with bronze goat-figure standard, horse-bit with wheel cheek-pieces and remains of buttoned woollen garment. The other publication, *Oruzhenie i voennoe delo drevney Armenii* (*Armament and Military Matters of Ancient Armenia*, Erevan, 1966, 155 pages, 23 figs.) contains a general account of weapons and armour from third to first millennium B.C., arranged under types: spears, daggers, swords, helmets, etc., and also wheeled transport.

The prehistoric past of Azerbaijan has been dealt with in *Zemledelie i Skotovodstvo v Azerbaidzane v Epokhu Bronzy* (*Agriculture and Animal Husbandry in Azerbaijan during the Bronze Age*, Baku, 1957) by R. A. Buniatov. The book is not available in London, but according to the very favourable review by R. M. Munchaev (*SA* 1958(4), pp. 236–239) this is an important work dealing with the development of agriculture and pastoral economy not only in Azerbaijan, as suggested by its title, but in Transcaucasia as a whole. The results of the excavation of the important settlement of Mingechaur on the Kura have been published in *Drevniy Mingechaur. Epokha Eneolita i Bronzy* (*Ancient Mingechaur. The Aeneolithic and Bronze Age*, Baku, 1959, 191 pages, 115 figures, 47 plates) by G. M. Aslanov, R. M. Vaidov and G. I. Ione. Remains of nine huts, over 200 flat graves and 8 barrow-graves of the Bronze Age were investigated; they date from the thirteenth to the end of the eighth centuries B.C. The book contains a complete list of all coeval sites in Azerbaijan with a brief account of each. A table sets out the results of spectroscopic analysis of all the metal objects excavated at Mingechaur, and Plate I contains figures of all the characteristic remains of the area arranged in successive chronological groups up to the twelfth century A.D. Finally, K. Kh. Kushnareva published the report on the excavation of the settlement of Uzerlik-Tepe near Agdam in southern Azerbaijan (*MIA* 67, 1959, pp. 388–430). The settlement was in existence from about the mid-second millennium B.C., and its upper strata were of the third to first centuries B.C.

Byelorussia

Neolithic and Bronze Age remains of Polesia (Corded Ware, the Trzcinec culture, etc.) have been listed and briefly described by Iu. V. Kukharenko in a special volume (*SVOD* b-1-18, 1962), and their distribution shown by a series of maps. Of considerable importance are the results of intensive investigations by I. I. Artemenko in various parts of the country, which have brought to light new groups of Neolithic and Bronze Age remains. Some of the relevant reports by this author, which refer to the earlier remains, have been mentioned

in my first article. Flat cemeteries, barrow-grave cemeteries and settlements or occupation sites of the Bronze Age, of the second millennium B.C., have been considered by Artemenko (*SA* 1963(2), pp. 12–37) to be a late development of the Middle Dnieper culture of the blackearth region south and south-west of Kiev, and to form a local northern branch of the Dnieper-Desna group of that culture. However, the different ecological conditions in these two regions (the forest zone of Byelorussia and the forest-steppe zone south of Kiev), the difference in the content of both groups and the chronology of the related finds, are against considering them as forming a single culture. In fact, the Dnieper-Desna group in Byelorussia was an independent culture which developed parallel to the Middle Dnieper culture of the Ukraine; the similarity of some of their vessels was due to the fact that both were offspring of the Corded Ware assemblage.

Several preliminary reports by I. I. Artemenko (*KSIIMK* 78, 1960, pp. 34 ff.; *KSIAM* 84, 1961, pp. 63 ff.; 88, 1962, pp. 64 ff.) contain brief descriptions of settlements investigated mainly in the region of Gomel, and occupation sites recorded there. Of special interest are barrow-graves at Moshka-Khodovichichi on the Dnieper (*Pamiatniki Kamennogo i Bronzovogo Vekov Evrazii*, Moscow, 1963, pp. 31–87), some of which were richly furnished with bronze ornaments and weapons; and a flat cemetery uncovered at Strelitsa near Gomel on the Sozh (*NSA*, pp. 110–115). Chemical analysis of bronze objects excavated in the latter has shown that their metal was of Transilvanian origin. Of importance were bronze ‘diadems’, or rather collars, the nearest analogies to which may be found in several regions of the northern part of Central Europe. The description of all remains, settlements and graves of the Dnieper-Desna culture, jointly with those of the Middle Dnieper culture, and an exposition of the ideas put forward in the preliminary reports have been included in the recently published work by I. I. Artemenko, *Plemena verkhnego i srednego Podneprov'ia v epokhu bronzy* (*Tribes of the country on the upper and middle Dnieper in the Bronze Age*, *MIA* 148, 1967, 139 pages, 78 figs.). It contains a detailed study of pottery and of all grave-goods of the culture. Of special interest are potsherds and a vessel characteristic of the Globular Amphora culture (figs. 35: 1, 3; 48), although not recognized as those by the author. The initial date of the culture, proposed at c. 2400 B.C., has been estimated at least five or four centuries too high.

Connections of the Dnieper-Desna culture with the Trzciniec and Komarów cultures have been discussed by I. I. Artemenko (*KSIAM* 1081, 1964, pp. 9–18; *SA* 1961(2), pp. 232–236) and by F. M. Zaverniaev (*SA* 1964(1), pp. 146 ff.). The Trzciniec current, which reached that region and likewise that on the lower Desna and on the Seim further east, was responsible for the transformation of the Dnieper-Desna culture into a new one, called the Pochepe culture by F. M. Zaverniaev, but considered by I. I. Artemenko to form a northern branch of the Sosnitsa culture, which is characteristic of the country of the lower Desna and the Seim.

Central Russia

Intensive excavations have been undertaken in Central Russia, especially in the region on the upper Volga, hitherto rather neglected by archaeological research. Several stratified sites were investigated, preliminary reports on which were quoted in my first article. In most of these, besides the early remains of the Pit-comb ware culture, were found also remains of the Balakhna culture (second millennium B.C.), as well as those of later periods. The Balakhna culture was especially well represented at Sokolskoe I on the Volga (L. Ia. Krizhevskaya, *MIA* 110, 1963, pp. 30-48), and at Serkovo (I. V. Gavrilova, *MIA* 110, 1963, pp. 49-53). The stratified site of Malyi Ostrovok on Lake Sakhtysh, and two similar sites at Volodary near Gorki and Podboritsa on the lower Oka, were described, and the results obtained discussed, by A. F. Dubin (*NSA*, pp. 127-132); the author also discussed there the sequence of cultures and implications involved. Of interest also is the article by V. V. Fedorov and V. P. Tretiakov (*SA* 1966(4), pp. 105-115); it contains the report on the investigation of the site of Vyselki, at Bolshoe Kozino on the Volga. The authors emphasize that two types of pottery were found there, which cannot be regarded as forming part of a single 'Balakhna culture'. The first was a genuine Balakhna ware, a variety of that typical of the Volga-Oka assemblage; the other was of alien origin, and closely related to that of the Gorbunovo culture of the Urals.

I. K. Tsvetkova, in a contribution mentioned in my first article (*MIA* 110, 1963, pp. 54-84), describes all sites of the Balakhna culture on the Volga, and distinguishes three consecutive periods in their development; characteristic features of each of the periods, and relations with other coeval cultures are demonstrated. A study of a more general character is provided by D. A. Kraynov (*KSIAM* 97, 1964, pp. 3-19); this likewise was mentioned in my first article. The author discusses the development and the sequence of cultures in the area between the upper Volga and the Oka, from the Mesolithic up to the end of the second millennium B.C. Kraynov (*KSIIMK* 75, 1959, pp. 63 ff.) emphasizes also that at the site of Zolotoruchie I, and at other sites in that region, Fatyanovo pottery was excavated in layers which overlay that with the Pit-comb ware; this indicates that the Fatyanovo culture was subsequent to that of the Pit-comb ware, not contemporaneous with it, as maintained by some scholars. Of interest also are the results of the investigation by the same author (*AO* 1966, pp. 54-57) of a settlement Sakhtysh VII, and of a number of graves which belonged to it; about 100 amber beads and ornaments were found there.

A number of articles dealing with particular questions may also be mentioned. O. S. Gadzyatskaya (*KSIAM* 106, 1966, pp. 16-26) describes all the bone objects found at Sakhtysh II, of the late third and the whole of the second millennia B.C., and divides them (harpoons, Shigir points, amulets, ornaments, etc.) into chronological groups. Sites of the Neolithic and the Bronze Age of the region of Kostroma have been registered and mapped by N. N. Iablonkova

(*MIA* 110, 1963, pp. 25 ff.) and flint arrow-heads of that region discussed by N. V. Gavrilova (*MIA* 131, 1965, pp. 204–213); the latter author points out that those of the ‘Seima’ type were very common in late sites of the Balakhna and Volosovo cultures in the Volga-Oka country. She also distinguishes two other types of contemporary arrow-heads and discusses their chronology and their geographical diffusion. The genesis of the ‘textile’ pottery of north-eastern Europe was considered by O. N. Bahder (*SA* 1966(3), pp. 32–37); according to him the earliest examples appear at about the middle of the second millennium B.C.

M. P. Zimina (*SA* 1963(1), pp. 278 ff.) describes the results of her investigation of Lopachi in the southern part of the area under review, in which remains of the Riazan culture were found in the earlier occupation level, and those of the Pozdniakovo culture in the later one; there was no continuity in the development, no ‘genetic connection’ between these two cultures. Another site of the Riazan culture, at Chervona Gora, was excavated by I. K. Tsvetkova (*KSIIMK* 75, 1959, pp. 114–122); here again, the upper layer was of the Pozdniakovo culture.

The North

N. N. Gurina, in her new work, *Iz istorii drevnikh plemen zapadnikh oblastey SSSR* (*On the History of the Ancient Tribes of Western Provinces of the USSR*, *MIA* 144, 1967, 207 pages) discusses the results of the investigation of several settlements on the Russo-Estonian border, especially the excavation of three settlements on the river Narva, called Narva I, II and III. They were mainly of the Neolithic but some survived till the mid-second millennium B.C.

The literature concerning not only the Neolithic, but also the Bronze Age (second millennium B.C.) of the northern (‘Arctic’) part of Russia, north of the Volga, was cited in my first article. However, an important publication was not mentioned, it not being available then in London. This is *Plemena Karelii v epokhu neolita i rannego metalla* (*Tribes of Karelia during the Neolithic and the Early Bronze Age*, Moscow-Leningrad, 1964, 193 pages, 38 plates) by G. A. Pankrushev. It deals with the development of Karelia from c. 5000 to c. 500 B.C.: three distinct provinces have been distinguished, and the development of the culture in each of these divided into three periods, which did not correspond with those of the neighbouring areas. This is well demonstrated by the chronological table. Results of new investigations in Karelia have been published in the volume *Novye pamyatniki Istorii drevney Karelii* (*New Remains of the History of Ancient Karelia* (1966)). Two articles, both by S. V. Oshibkina, deal with topics connected with the Kargopol culture. In one of these (*SA* 1966(1), pp. 265–269) late Kargopol sites of the end of the second and early first millennium are discussed, and a preliminary report on investigation of the site of Yakovlevo published. In the second (*SA* 1966(4), pp. 27–37) the reciprocal

relations of layers Modlona I and II has been discussed. The author disagrees with M. E. Foss who considered the site to be of the Kargopol culture; she attributes Modlona I to the Volosovo culture and is of the opinion that Modlona II was a further development of its predecessor, its culture being somewhat changed to suit local conditions. A map shows the diffusion of sites of the Volosovo culture, and especially of those which yielded amber objects.

The Fatyanovo culture

A relatively large number of newly discovered graves and cemeteries of the culture have been published in a series of articles by O. S. Gadziatskaya (*SA* 1963(1), pp. 284 ff.; *KSIAM* 93, 1963, pp. 49–54; 101, 1964, pp. 126 ff.), N. A. Kiryanova (*KSIAM* 101, 164, pp. 121 ff.), D. A. Kraynov (*KSIAM* 84, 1961, pp. 83–90; *SA* 1964(4), pp. 68–83), A. Nikitin (*SA* 1964(3), pp. 277–282), and O. N. Bahder (*KSIIMK* 75, 1959, pp. 143 ff.; *ASE* 5, 1963, pp. 5–30). In a grave at Mytishchi, published by the last author, a wide decorated bronze wrist-band of Unetice type was found and the anthropological study of the cranial material from another cemetery published by him (Kuzmino near Moscow) revealed that the people buried there were of a type similar to that characteristic of north-west Europe (Nordic type). I. I. Artemenko (*KSIAM* 93, 1963, pp. 55–57), in describing a Fatyanovo cemetery at Olochino in the province (oblast) of Kalinin, expresses the opinion that the Fatyanovo and the Dnieper-Desna ('Middle Dnieper') cultures formed only two variants of a single culture.

The geographical distribution of the newly discovered graves considerably enlarged the area attributed hitherto to the Fatyanovo culture, as emphasized by O. N. Bahder (*NSA*, pp. 119–124) and D. A. Kraynov (*NSA*, pp. 115–118; *KSIAM* 106, 1966, pp. 55–65). The latter thinks that westwards it extended even up to the Baltic coast. Of importance for the study of the culture are the two issues of *SVOD*, which have appeared so far, both by D. A. Kraynov (B-1-19, 1963; B-1-20, 1964); they contain lists of all sites, description of all burials and of other remains of the Moscow and Iaroslav-Kalinin groups of the culture, each of the volumes supplemented by a large number of plates and several maps.

The leading types of the Fatyanovo pottery have been discussed by P. M. Kozin (*SA* 1963(3), pp. 25–37; *NSA*, pp. 124–127), who produces ample evidence ('Thuringian amphorae') for the western origin of the culture; in spite of that he puts forward the thesis of its eastern derivation. Finally, *Ursprung und Herkunft der zentralrussischen Fatjanowo Kultur* (Berlin, 1962, Berliner Beiträge zur Vor- und Frühgeschichte vol. 4) by J. Ozols may be mentioned. It deals with the two main cultural groups, Moscow and Yaroslav, describes the relative finds, and discusses the chronology and origin of the culture and its relations with other cultures. The author is of the opinion that the roots of the Fatyanovo culture lay in the Caucasus and within the Yamnaya culture.

The Balanovo culture

The Balanovo culture, its standard (flat) cemetery, its division into stages and its chronology, origin and other connected topics have been dealt with in *Balanovskii Mogilnik (The Balanovo Cemetery*, Moscow, 1963, 370 pages) by O. N. Bahder. The theses of the book were outlined in advance in an article by the same author (*SA* 1961(4), pp. 41–65). He is of the opinion that the Balanovo culture, although closely related to the Fatyanovo culture, was nevertheless independent of it. These views, which seem to be correct, are not shared by all Soviet authors, e.g. D. A. Kraynov and P. M. Kozin (in their articles quoted in the preceding section). The diversity of opinion leads to confusion, many remains of the Balanovo culture being published under the label of Fatyanovo, which relates especially to settlements found mostly within the Balanovo territory, e.g. V. F. Kakhovskii (*SA* 1962(1), pp. 152 ff.) or P. D. Stepanov (*SA* 1958(2), pp. 124–136), including the archaeological map by the latter author (*MIA* 80, 1960, pp. 221–272) of the country west of the middle Volga, with a full list of sites and the relative references.

New discoveries of the early Balanovo remains in the Chuvash country west of Kazan, the centre of the Balanovo culture, have been described by A. Kh. Khalikov (*KSIAM* 97, 1964, pp. 50 ff.), and V. F. Kakhovskii (*SA* 1963(3), pp. 169 ff.) publishes the results of investigation of the barrow-grave at Churachiki, in which a debased 'Thuringian' amphora was found in a burial associated with a copper shaft-hole axe and moulds for casting similar objects. A late Balanovo barrow-grave of Khula-Siuch type, of the end of the second millennium, was described by T. A. Kravchenko (*SA* 1964(3), pp. 282–288), who also points out the strong influence which the Srubnaya culture must have exercised on the indigenous population of the country of the middle Volga. Finally, the relationship of the culture with the Abashevo culture was the theme of several articles; they will be dealt with in the following section.

The Abashevo culture

The culture has been dealt with by several scholars, but many questions connected with it, e.g. its origin, still remain enigmatic, and opinions in this respect differ considerably, as shown by O. N. Evtiukhova (*SA* 1966(1), pp. 23–31). A special volume in the *MIA* series (97, 1961, 226 pages) has been devoted to the culture. It contains six contributions, by O. N. Evtiukhova (pp. 5–14, 27–42), A. P. Smirnov (pp. 15–26), P. P. Efimenko and P. N. Tretiakov (pp. 43–110), N. Ia. Merpert (pp. 111–156) and A. Kh. Khalikov (pp. 157–241), in which various problems concerning the culture and its relations with neighbouring cultures, including the Balanovo culture, are discussed.

A brief account of the Abashevo culture has been published (in Russian) by Tretiakov (*Pamatky archeologické* 52, Prague, 1962, pp. 374–383, with illustrations and a map). The culture and its role in the formation of the

Ananino culture of the early Iron Age in eastern Russia have been discussed by A. P. Smirnov (*MIA* 95, 1961, pp. 68 ff.).

New discoveries, graves, the excavation of semi pit-dwellings in settlements in the Chuvash country, west of the middle Volga, have been described by V. F. Kakhovskii (*Arkheologicheskie Raboty v Chuvashskoy ASSR*, XXV, 1964; *SA* 1962(1), pp. 152–162). According to Kakhovski two different peoples lived side-by-side in the country in the fourteenth to thirteenth centuries B.C., at the time of the formation of the Abashevo culture: one agriculturalists and stock-breeders; the other hunters and fishers. Settlements north of the Volga, eastwards up to the Vyatka, have been dealt with by A. Kh. Khalikov (*SA* 1959(2), pp. 148–168). One of the westernmost cemeteries attributed to the Abashevo culture has been published by D. A. Kraynov (*KSIAM* 88, 1962, pp. 51–63); this was the barrow-grave cemetery at Kriushino on the Kukhmar, in the Yaroslav province (*oblast*), 21 mounds of which were excavated.

The country of the middle Volga

The very confused conditions during the second millennium B.C. in the country of the middle Volga (mainly in the area south of Kazan up to the steppe border near Kuibyshev), have been discussed in a large study by N. Ia. Merpert (*MIA* 61, 1958, pp. 45–156); special attention has been paid there to the development of the local culture of Neolithic ancestry, and to its changes and transformations caused by its saturation by alien elements from the neighbouring countries, and (during the later period) by the impact of the expanding steppe cultures, the Srubnaya and Andronovo. The same author, in another article (*MIA* 80, 1960, pp. 7–21) describes barrow-graves investigated at Urazmamentovo in the southern part of the Chuvash country (west of the middle Volga), which he dates as c. fifteenth century B.C. Finally, several Neolithic and Bronze Age sites and settlements of the second millennium B.C. in the area have been described by A. Kh. Khalikov (*MIA* 61, 1958, pp. 11–44), as already mentioned in my first article.

The middle Kama and the Urals

Several stratified occupation sites were investigated in the country east of the middle Volga and in the Urals. Most of these yielded Bronze Age strata of the second millennium B.C., besides those of the Neolithic; reports have been quoted in my first article, in which I refer to the detailed references.

Bronze Age remains of the country of the middle Kama were dealt with mainly by O. N. Bahder, who paid special attention to the important cemetery of Turbino (*KSIAM* 86, 1961, pp. 108–112; *ASE* 6, 1964, pp. 103 ff.) and published the results of his excavation there in *Drevneyshie Metallurgi Priuralia* (*The Ancient Metallurgists of the country west of the Urals*, Moscow, 1964, 176 pages, profusely illustrated, with four colour plates). The position of the

cemetery, of the culture which it represents, its chronology, relations with other coeval cultures and other topics relating to it, are discussed. The date of the cemetery proposed there (1550–1450 B.C.) has been evidently estimated at least one century too high, as emphasized by L. Krizhevskaya and N. A. Prokoshev (*AF*, pp. 96 ff.) in their description of the same cemetery; they propose the period fifteenth to fourteenth centuries B.C.

Settlements of the Turbino culture have likewise been dealt with by O. N. Bahder (*KSIIMK* 74, 1959, pp. 110–123; *KSIAM* 85, 1961, pp. 73 ff.), who devoted to them a special book, *Poseleniya Turbinskogo Tipa v Srednem Prikame* (*Settlements of the Turbino Type in the country on the middle Kama*, *MIA* 99, 1961, 199 pages); their stratigraphy, local differences and chronology are discussed and the main emphasis is put on proving that the settlements had formed a single culture with the cemetery of Turbino.

The development of the Gorbunovo culture in the middle Urals (on their eastern side) has been discussed by V. M. Raushenbakh, in her book on that culture (Moscow, 1956) quoted in my first article. The culture, with those of a wider area east of the middle Urals of the second millennium B.C. (Neolithic and Bronze Age), has been dealt with by N. P. Kiparisova (*SA* 1960(2), pp. 7–24), who divided the relative remains into four consecutive chronological phases, and gives briefly their characteristics.

Reports on investigations of settlements of the second millennium B.C. (Neolithic and Bronze Age) in Bashkiria, the country west of the middle and southern Urals, have been published by L. K. Krizhevskaya (*SA* 1962(2), pp. 97–111; *AO* 1967, pp. 108–110) and K. V. Salnikov (*Bashkriskii Arkheologicheskii Sbornik*, Ufa, 1959, pp. 30–46). According to the latter, the country must have been within the area of extent of the Srubnaya culture. In the settlement of Beregovskoe I on the Belaya, Abashevo pottery was found in an earlier layer, of the fourteenth century B.C.

West Siberian forest zone

Several articles have been devoted to the Bronze Age cultures of the west Siberian forest and forest-steppe zones between the Irtysh and the Ob. Four cultures extending over four neighbouring areas in that region have been distinguished by M. F. Kosarev (*SA* 1964(3), pp. 37–44), who also discusses the climatic conditions during the second millennium B.C., when the northern steppe border lay considerably further north than at present. However, of special concern is the Samus culture, called after a group of settlements investigated in the vicinity of the town of Tomsk (V. I. Matiushchenko, *SA* 1959 (4), pp. 154–165; *KSIAM* 84, 1961, pp. 133–135; S. N. Zolotova, *KSIAM* 101, 1964, pp. 59–63). A considerable number of moulds (mainly for casting bronze objects of Seima-Turbino type) imply that the settlements were important centres of the west Siberian bronze industry. Questions concerning the develop-

ment of this industry, its relation to that of the Andronovo culture and its connections with the middle Urals and the Seima-Turbino industries, have been discussed by M. F. Kosarev (*SA* 1963(4), pp. 20–26; 1966(2), pp. 24–32). This writer is of the opinion that the country of the middle Ob, on the border of the forest zone, and in particular the Samus culture, was the original centre of the Seima-Turbino bronze industry; celts found in the Turbino cemetery were of middle Ob (Samus culture) origin. The Samus culture was closely related to the Gorbunovo culture; its bearers were the Proto-Ugrians, whereas those of the Karasuk culture in the country further east, on the Yenisey, were probably a people of the Tibeto-Burma linguistic group.¹⁸

The Andronovo culture

This was the most important culture of the regions east of the Urals. It extended over the whole west Siberian steppe zone (Kazakhstan and the adjoining areas) east of the river Ural as far as the Yenisey, and later in the millennium it also expanded southwards into Soviet Central Asia.

A relatively large number of articles and special books have been devoted to the culture. M. N. Komarova (*ASE* 5, 1962, pp. 50 ff.) discusses the remains attributed to the culture, and distinguishes its separate groups, describing their characteristic features. Four periods have been distinguished in development of the culture, but according to Komarova the latest one of these does not belong to the Andronovo sequence; its constituting remains must be considered as characteristic of a distinct, the Zamaraevskaya, culture. M. F. Kosarev (*SA* 1965(2), pp. 242–246) disagrees with several views expressed by M. N. Komarova and submits his own interpretation of the changes in the content of the culture in the various parts of the country, which to a great extent were due to tribal movements. The division of the Andronovo culture into a series of regional groups, their reciprocal relations, resemblances and similar topics have also been discussed by S. S. Chernikov in the section devoted to the development of metallurgy in the work already quoted at the beginning of the present article (*MIA* 88). Questions relating to the Andronovo culture as a whole have also been discussed in several reports on the excavation of Andronovo remains in the different areas, dealt with below.

A general account of the south Ural (Orenburg-Orsk) group of the culture has been given by E. E. Kuzmina (*KSIAM* 88, 1962, pp. 84–92; 97, 1964, pp.

¹⁸ Three brief reports appeared recently in *AO* 1968 on West Siberian investigations. The first of these, by F. M. Kosarev (pp. 149–150), gives an account of the excavation of a settlement of the Samus culture of the Andronovo period on the lower Chulym north of Tomsk. In the second one, by V. I. Matiushenko, A. S. Chagaeva and L. A. Pavlenok (p. 153), several remains have been described and among these a cemetery with partial cremations on the spot was investigated on the river Om near Omsk; it has been wrongly dated to the fifteenth–thirteenth century B.C. A bronze knife of Turbino II type puts its date to the eleventh century B.C. The third report, by A. P. Khlobystin (pp. 147–149) is concerned with a settlement investigated in the southern part of the Yamal Peninsula, north of the mouth of the Ob. Drippings of copper were found there, and its flat-bottomed, pit-comb and stamp decorated pottery has been considered to be a variety of the Samus culture of the second part of the second millennium B.C.

39 ff.). The same author reports on her excavation of settlements in the region of Orsk and discusses their relative chronology (*SA* 1965(4), pp. 40–51). Special attention has been paid to the settlement at Shandasha (of the second half of the second millennium) in which a few semi pit-dwellings were uncovered (*AO* 1966, pp. 84–86; *KSIAM* 98, 1964, pp. 100 ff.); its inhabitants were engaged in foundry work. Settlements in the region of Dombarovskii, south-east of Orsk, which all lie in the area rich in deposits of copper ore, have been described by K. V. Salnikov and A. S. Novichenko (*SA* 1962(2), pp. 124–133); huts were built entirely or partly of stone.¹⁹

Barrow-graves investigated in that area were published in a preliminary report by M. G. Moshkova and E. A. Redorova-Davydova (*KSIAM* 101, 1964, pp. 135–141), in which strong Srubnaya influence on the local Andronovo group has been emphasized. Of interest is the description by E. E. Kuzmina (*KSIAM* 93, 1963, pp. 96–105) of her excavation of a barrow-grave cemetery at Kupukhta, which in many respects differed from other Andronovo cemeteries in that area. The author emphasizes that this was a burial ground of the Andronovo nobility.

Several articles by S. V. Sorokin were devoted to reports on the excavation, at Tasty-Butak in western Kazakhstan, of the Orsk group of the Andronovo culture. Here remains of a few huts were uncovered (*KSIAM* 91, 1962, pp. 51–60), and a barrow-grave cemetery investigated (*KSIIMK* 80, 1960, pp. 53–59); the full report on the latter was published in a special volume by the same author (*MIA* 120, 1964, 207 pages). The settlement and the cemetery were of the thirteenth to twelfth centuries B.C. Anthropological study of the cranial material revealed that the Mediterranean racial element was the prevailing one among the population of that period. Here this group differed from other groups of the Andronovo culture; it was very similar to the population of the Srubnaya culture in the country of the lower Volga. This was a distinct group of the Andronovo culture which in some respects differed from others of the Andronovo culture. The western remains of the Andronovo culture west of the Tobol have been described, and their chronology and relations with other cultures discussed in a special volume by V. S. Sorokin and his collaborators (*SVOD* B-3-2, 1966, with a map and 37 plates).

A series of articles has been devoted to the Bronze Age of other parts of Kazakhstan. A. M. Orazhaev, in a larger study 'Severnii Kazakhstan v epokhu bronzy' ('Northern Kazakhstan in the Bronze Age', *TIIAEK* 5, 1958, pp. 216–295, 37 figures in text, 12 plates) gives a short description of the previously investigated cemeteries and settlements of the period and reports (with plans of

¹⁹ E. E. Kuzmina, in a new report (*AO* 1967, pp. 113–114) gives a short account of recent investigations of two settlements in the area which show many traces of smelting copper from local ores and foundry work; they imply that there was an important centre of South Ural Andronovo bronze industry of the second millennium B.C.

graves) on those recently excavated. The whole material has been arranged into chronological groups corresponding with the subsequent stages in the development of the Andronovo culture. Of special interest is a richly furnished grave at Borovoe in which, besides golden ornaments, a few segmented faience beads were found (p. V: 17). The grave was of the Fedorovskii stage (1600–1500 B.C.). The beads must have been brought there from the west and may presumably be connected with the expansion of the Mycenaean-Trojan trade of that time. It is of importance to note in this context that at Stepnyak, at a distance of about 40 km. from Borovoe, traces of gold workshops were uncovered, which were already in existence at that time although their heyday was during the later periods. Gold extracted from local ores was worked (p. 265; see also S. S. Chernikov, *KSIMK* 53, 1954, pp. 29 ff.).

A brief review of Bronze Age remains, and also those of other prehistoric periods, of the three provinces (oblast) of Northern Kazakhstan, contains the article by K. Akishev, 'Pamyatniki stariny Severnogo Kazakhstana' ('Remains of the Olden Times of Northern Kazakhstan', *TIIAEK* 7, 1959, pp. 3–25, 7 plates); this volume also contains short reports on recent excavations in that area. A similar review of prehistoric remains of Central Kazakhstan was published by A. M. Orazbaev, 'Pamyatniki epokhi bronzy Centralnogo Kazakhstana' ('Remains of the Bronze Age of Central Kazakhstan', *TIIAEK* 7, 1959, pp. 59–74) in which newly excavated cemeteries in the country were also described; they consisted mainly of slab cist graves encircled by vertical stone slabs, with no mounds raised over them. M. K. Kadyrbaev, in his article 'Mogilnik Sanguyr II' ('Cemetery Sanguyr II', *TIIAEK* 12, 1961, pp. 48–61) gives an account of his excavation in the Karaganda province (oblast) of an Andronovo cemetery of the Alakulskii period (twelfth to eleventh centuries B.C.). It contained stone mounds raised over poorly furnished slab-cist graves. Of special interest were barrow-graves to which, to the south-east, were attached a kind of open-ended forecourt, approximately oval in plan, defined by two curving walls confronting one another, the walls ending in small stone cairns. A. V. Vinogradov, in the article 'Arkheologicheskaya razvedka v rayone Aralska-Saksauskoy v 1955 godu' ('Archaeological Survey in the region of Aralsk-Saksauskii in 1955', *TIIAEK* 7, 1959, pp. 75–85) reports on the results of his survey of the area north of the Sea of Azov in Southern Kazakhstan. Several sites of the periods from the Neolithic to the Late Bronze Age have been recorded.

The Bronze Age of Eastern Kazakhstan has been dealt with by A. G. Maksimova in a larger study already mentioned, 'Epokha bronzy Vostochnogo Kazakhstana' ('Bronze Age of Eastern Kazakhstan', *TIIAEK* 7, 1959, pp. 89–139, 23 tables). Investigated settlements and cemeteries of the period have been briefly described and all types of remains discussed. E. I. Ageeva and A. G. Maksimova, in the article 'Otchet Pavlodarskoy ekspeditsii 1955 goda' ('Report

of the Pavlograd Expedition of 1955', *TIIAEK* 7, 1955, pp. 32–58) give an account of the results of their survey of the northern part of Eastern Kazakhstan. Remains of the Bronze Age and of later periods, up to the fifteenth century A.D., have been recorded. A few graves excavated in different cemeteries have also been published; they belonged to various periods of the Bronze Age.

Of importance are two reports on the excavation of flat cemeteries of the late period (Alakulskii) of the Andronovo culture, of the later part of the second millennium B.C., in the region north-west of Alma-Ata, on the northern side of the Chu-Iliyskiye Mountains, both published by A. G. Maksimova: 'Mogilnik epokhi bronzy v urochishche Karakuduk' ('Cemetery of the Bronze Age in the site of Karakuduk', *TIIAEK* 12, 1961, pp. 62–67), and 'Mogilnik epokhi bronzy v urochishche Tau-Tary' ('Cemetery of the Bronze Age at the site of Tau-Tary', *TIIAEK* 14, 1962, pp. 37–56).

Andronovo cemeteries of the easternmost group, in the basin of the Yenisey, have been discussed and published in a series of articles by several authors. The barrow-graves in the northern part of Khakassia, on the northernmost spurs of the Altai, have been described by M. N. Komarova (*ASE* 3, 1961, pp. 32–73) who also deliberates on the origin of the local group and its development. The relation between the Afanasevo and Andronovo cultures, the position of the Okunevo remains and relations with other Andronovo groups have been discussed by G. A. Maksimenko (*SA* 1965(4), pp. 204 ff.) The true attribution of stone stelae with solar signs and other incisions was the theme of an article by E. B. Vadetskaya (*SA* 1965(4), pp. 211–219).

South Siberia, the Altai and the country around Lake Baikal

The development in the region of Krasnoyarsk during the Neolithic and the Bronze Age has been discussed by G. A. Maksimenkov, 'Ust-Sobachkinskaya stoyanka i ee znachenie dlia izucheniya drevney istorii rayona Krasnoyarska' ('Ust-Sobachkinskaya and its importance for the study of the Ancient History of the region of Krasnoyarsk', *SAS* 2, 1966, pp. 77–83).

Several sites of the time from the third to first millennia B.C. were investigated further east, on the Podkamennaya Tunguska and on its tributary the Chuya, and the results published in a series of articles by G. I. Andreev, Iu. M. Fomin and P. P. Pashin (*KSIAM* 101, 1964, pp. 94–98 (with a map), 99–101; 106, 1966, pp. 106–110; *SA* 1965(3), pp. 100–113).

According to G. A. Maksymenkov (*KSIAM* 101, 1964, pp. 19–23; *NSA*, pp. 168–174), the Okunevo culture which, early in the second millennium B.C., had replaced the Afanasevo culture in the Yenisey (Minusinsk) valley, cannot be looked upon as a branch of the Andronovo culture. He maintains that this was a distinct culture, in some way related to the Samus culture of the forest zone, which later (by the mid-second millennium B.C.), was replaced by the Andronovo culture. A further change occurred in about the fourteenth to thirteenth centuries B.C. when the latter was overrun by the Karasuk culture.

The Karasuk culture and its development has been dealt with by E. A. Novgorodova (*NSA* pp. 181–186). She distinguishes a few local groups and three periods in its development dated respectively fourteenth to twelfth centuries, twelfth to ninth centuries and ninth to eighth centuries B.C. The differences in the extent of the culture during these periods, and its relation to its preceding Andronovo and Okunevo cultures have been discussed. A. I. Martynov (*SA* 1964(2), pp. 122–133) established a new group of the Karasuk culture in the area of the river Ini. The very strong Andronovo background on which this group developed was well discernible. Late Karasuk remains and the gradual transformation of the culture into the following Tagar culture, which was completed by the seventh century B.C., were the theme of a study by N. L. Chlevova (*SA* 1963(3), pp. 48–68). The same author discusses the origin of the culture ('Karasukskaya kultura v Iuzhnoy Sibiri', *Istoria*,²⁰ pp. 263–279). She emphasizes, against widely held views, that the roots of the Karasuk culture did not lie in the south-east, in China. The prototypes of its characteristic bronze industry, close analogies to its decorative animal style and to other features of the culture, can be found only in the south-west, in Soviet Central Asia (the Fergana-Pamir region) and in Iran. The Karasuk people must have been the south-western newcomers in the Minusinsk valley in the later part of the second millennium B.C. Finally, remains of the Karasuk culture in the region between the rivers Ob and Chulym, east of Tomsk, have been described and their chronology discussed, by A. I. Martynov ('Karasukskaya epokha v Ob-Chulymskom mezhdurechie', *SAS* 2, 1966, pp. 164–182).

L. P. Kyzlasov (*NSA*, pp. 165–168) describes the stone shaft-hole axes found in the metalliferous regions in the Altai Mountains, and emphasizes that they represent an entirely alien element in the Afanasevo culture of that region. These tools, which date from the early second millennium B.C., point to connections with the Catacomb culture; connections must have been maintained across the steppe country of western Siberia (Kazakhstan). Of importance is the fact that the stone axes, and a few other objects which reproduce western types, e.g. the 'incense burners' have always been found in the Altai Mountains in areas where traces of ancient mines have been discovered, or outcrops of metal ores exploited in the first half of the second millennium B.C.

Investigations in the country east of the Yenisey, as far as Lake Baikal, have been published in several articles. Karasuk graves at Idan on the upper Angara, north of Irkutsk, have been published by E. R. Rygdylon and P. P. Khoroshikh (*SA* 1958(3), pp. 184–185). A long-lived stratified settlement was excavated by L. P. Khlobystin (*KSIAM* 97, 1964, pp. 25–32) at Ulan-Khada on the Baikal Sea; its occupation layer was 3 m. thick and had six horizons, of which the Neolithic horizon of the second millennium B.C. was the thickest.

²⁰ *Istoria Sibiri Materialy po drevney Istorii Sibiri*, vol. I Ulan-Uda, 1964.

A 'Late Neolithic' (second millennium B.C.) cemetery at Irkutsk has been published by P. P. Khoroshikh, 'Neoliticheskii mogilnik na stadione 'Lokomotiv' v g. Irkutske' ('Neolithic cemetery on the Stadium 'Lokomotiv' at Irkutsk', *SAS* 2, 1966, pp. 84-93), and Neolithic and Early Bronze Age sites near Chita, east of the Baikal Sea, in the region between the rivers Khilok and Nercha, have been described by V. E. Larichev and M. N. Pizhskii, 'Ozernyi neolit i rannaya bronza Vostochnogo Zabaikalya' ('The Late Neolithic and Early Bronze Age of the country east of the Baikal Sea', *SAS* 2, 1966, pp. 94-128).

Soviet Central Asia

Several books quoted in my first article contain also chapters dealing with the remains of the second millennium B.C., including a few reports on new excavations of sites of this period and discussions of some specific problems involved in them. Among these are the book by S. P. Tolstov, *Po Drevnim Deltam Oksa i Yaksarta (Along the Deltas of the Oxus and the Iaxartes)*, Moscow, 1962, 324 pages); volumes II (1958) and IV (1959) of *Trudy Khorezmskoy Arkheologo-Etnograficheskoy Ekspeditsii*, (articles by P. S. Tolstov (pp. 7-258) and by M. A. Itina (pp. 5-62) respectively. Articles dealing with this subject also appear in various numbers of *MKE*, including those in volume 1 (1959) by N. N. Vakturskaya (pp. 39-51) and M. I. Itina (pp. 52-69); in volume 4 (1960) by S. P. Tolstov (pp. 3-62), A. V. Vinogradov (pp. 63-81), and M. A. Itina (pp. 82-103); in volume 6 (1963) by A. V. Vinogradov (pp. 91-102). Here also belongs volume 5 (1961) which is entirely devoted to the work by M. A. Itina *Mogilnik bronzovogo veka Kokcha 3 (Cemetery of the Bronze Age at Kokcha)*, supplemented by a study of the cranial material from that cemetery by T. A. Trofimova, and with two smaller contributions by other authors. In another report by S. P. Tolstov (*SA* 1958(1), pp. 106 ff.), the excavation at Barak-Tam has been briefly described; Kelteminar remains were found there. In a special article, S. P. Tolstov and M. A. Itina (*SA* 1960(1), pp. 14-35) describe the Suyarganskaya culture and discuss its relations with its coeval Kelteminar culture.

The southern expansion of the Srubnaya and Andronovo cultures in the second half of the second millennium B.C., and their share in the formation of the Tazabagyabskaya culture of Chorasmia have been discussed in a series of articles by M. A. Itina (*SE* 1962(3), pp. 108-120; 1967(2), pp. 62-79).

The book by V. M. Masson, *Srednyaya Aziya i Drevnii Vostok (Central Asia and the Ancient Orient)*, Moscow-Leningrad, 1964), likewise deals with conditions during the second millennium B.C. A brief account of new excavations of sites of periods Namazga IV-VI was published by V. M. Masson, V. I. Sarianidi and I. N. Khronin (*AO* 1966, pp. 66-74). In another article, V. M. Masson (*KSIAM* 108, 1966, pp. 39-44) discusses the development of defensive

constructions (walls) in Central Asia and Transcaucasia during the period from the fourth to the end of the second millennium B.C. Of interest is a report by A. M. Mandelshtam (*KSIAM* 108, 1966, pp. 105-108) on the investigation of



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| 1 Shandasha and Bobrikovo | 16 Pazyryk barrow-graves |
| 2 Settlements in the region of Dombarovskii | 17 Sites on the river Inia |
| 3 Kupukhta | 18 Samus |
| 4 Tasty-Butak | 19 Okunev |
| 5 Barak-Tam | 20 Ust-Solachkinskaya |
| 6 Patma-Say | 21 Sites on the Podkamennaya Tunguska |
| 7 Anau | 22 Sites on the Chuya |
| 8 Namazga-Depe | 23 Tura on the Lower Tunguska (Nizhnaya Tunguska) |
| 9 Zaman-Baba | 24 Idan |
| 10 Dalverzinskoe | 25 Ulan-Khada |
| 11 Chust | 26 Sites in the region of Chita |
| 12 Tegirmen-Say | 27 Krasino |
| 13 Sites in the valley of the Kassansay | 28 Kirovskoe |
| 14 Sites in the valley of the Chadaksay | 29 Nogliki |
| 15 Tin mines (crosses) | 30 Lake Ushkovskoe |

a barrow-grave, Patma-Say, on the slopes of the Bolshyii Balkhan Mountains in the western part of Turkmenia (about 100 km. east of the Caspian Sea), in which a Srubnaya burial was uncovered.

A grave, richly furnished with bronze objects, investigated in the environment of Samarkand, has been described by D. N. Lev (*KSIAM* 108, 1966, pp. 101–104); pottery of the Andronovo culture (of the Alakulskii type) of the mid-second millennium was found in it. Further east, at Zaman-Baba on the Zeravshan, a settlement was investigated by A. Askarov (*KSIAM* 93, 1963, pp. 86–92); it belongs to the Zaman-Baba culture, so called after the cemetery previously excavated there, and dating from the same period, the first half of the second millennium B.C.

The results of the investigation of the stratified settlement at Dalverzinskoe in Fergana were published by Iu. Zadneprovskii (*KSIAM* 86, 1961, pp. 43–54). Pottery of the earliest horizon (second half of the second millennium B.C.), was similar to that of Namazga VI; the settlement was in existence till about the end of the first millennium B.C. The same author, in *Drevnezemel'delcheskaya Kultura Fergany* (*The Early Agricultural Culture of Fergana*, *MIA* 118, 1962, 328 pages, 78 plates (two coloured); a brief summary in English) discusses the development of the agricultural population of the country; the first chapter (pp. 11–70) is devoted to the Chustskoe culture, the earliest agricultural culture in that region, which developed there during the second half of the second millennium B.C. Investigations of newly discovered settlements of the Bronze Age in Fergana, in the valley of the Kassansay, were reported by Iu. G. Chulanov (*SA* 1963(4), pp. 194–199). Finally, A. Abetkov (*KSIAM* 93, 1963, pp. 93–95) reports on the excavation of a cemetery at Tegirmen-Say in Kirgizia, at a distance of about 25 km. from Frunze; remains found there are closely related to those of the Alakulskii type of the Andronovo culture of Kazakhstan.

Soviet Far East

Several articles and books bring the results of investigations in parts of the Soviet Far East. A special volume of the *MIA* series *Drevnie Kultury Dal'nego Vostoka* (*Ancient Cultures of the Far East*, *MIA* 86, 1960, 244 pages) consists of articles by 12 authors, some of which deal with topics relating to the second millennium B.C. Among these is the article by O. P. Okladnikov describing remains investigated on the upper Amur river; by V. E. Larichev describing the sites of the Primorskii Kray (the country between the lower Amur and the sea, southwards as far as Vladivostok); and problems concerning the cultures of the southern part of that country during the period from the third to the first millennia B.C., were dealt with by G. I. Andreev. A book in the same series by A. P. Okladnikov, *Drevnee Poselenie na Poluostrove Peshchanom u Vladivostoka* (*Ancient Settlements on the Peninsula of Peshchanyi near Vladivostok*, *MIA* 112, 1963, 356 pages, 142 plates, 74 figures (two in colour) supplemented by smaller contributions by eight authors), deals with the second period in the development of several settlements in that area, during the second millennium. Among these was the settlement of Kirovskoe, mentioned in my first article.

A. P. Okladnikov, in the article 'Drevnee poselenye u izvestkovogo zavoda blizi s. Ekaterininskogo' ('Ancient settlement near the lime factory at the village of Ekaterininskoe', *SAS* 2, 1966, pp. 131-146) describes a settlement on the Sedima, close to its junction with the upper Amur. Two other articles by A. P. Okladnikov (*KSIIMK* 73, 1959, pp. 107-114; *SA* 1966(1), pp. 32-41), contain reports of excavation of several sites and discuss wider problems relating to the Neolithic development (second millennium B.C.) in the Soviet Far East, and the reciprocal relations of the local culture with its coeval cultures of China. Of the same type also are articles by G. I. Andreev (*KSIAM* 93, 1963, pp. 106-113; 97, 1964, pp. 98 ff.; 106, 1966, pp. 99 ff.), and another by the same author jointly with Z. A. Andreeva (*KSIAM* 88, 1962, pp. 93-101). In the first article by Andreev, a map has been published of all sites in the southern part of the Primorskii Kray, east and west of Vladivostok. One of the most important of these was the stratified site at Kraskino. The author also emphasizes that bronze objects were already cast locally in the second millennium B.C.

R. V. Chubarova (*KSIIMK* 73, 1959, pp. 115-121; *KSIAM* 85, 1961, pp. 48-51) published the results of her investigation of a series of Neolithic sites of the second millennium B.C., and of subsequent periods, on the island of Sakhalin, especially of the site of Nogliki I at the mouth of the river Tym, on the eastern side of the island.

Finally, a few western publications relating to Siberian archaeology of the second millennium ought to be mentioned here. One of these is the English translation of the large article by A. P. Okladnikov, *Ancient Populations of Siberia and its Cultures* (Cambridge Mass. 1959, Peabody Museum publication, 96 pages, 25 plates, 3 maps). Another is the volume *The Archaeology and Geomorphology of Northern Asia* (ed. N. Michael, Toronto, 1964, Arctic Institute of North America, publication no. 5, 512 pages; it contains 19 articles, translations from selected works by Soviet authors). The third volume is *The Soviet Far East in Antiquity. Notes on the Ancient and Mediaeval History of the Maritime (Kray) Region* (Toronto, 1965, publication no. 6 of the same Institute) by A. P. Okladnikov; the work was originally published in Russian in Vladivostok in 1959.

A Monument with Amarna Traits

by H. M. STEWART

The sculpture, British Museum No. 1222¹ (pl. II), carved in sandstone and 56 cm. in height, was bought in Luxor in 1897. It is of a type which was fairly common during the New Kingdom,² and represents the scribe, etc. Nakhtmin kneeling in worship and addressing to Re-Harakhti a funerary prayer which is inscribed on the stela. Shown in incised relief also on the monument are his wife Muttuy and family in similar attitudes. The inscriptions with a photograph of the stela only have already been published in Edwards, *Hieroglyphic Texts*, VIII, 52 f., pl. 44, where the object is dated to the New Kingdom. A comparative study of such statues, however, and certain stylistic features suggest that a closer dating may be possible.

The type of statue with stela resting on the ground represents a stage of its development which was reached at about the time of Amenophis II, and the duplex style of the figure's coiffure would confirm this as the earliest date.

In the arch of the stela Nakhtmin and his wife are shown kneeling with arms fully outstretched towards the sun-disk, which rests in the solar bark. This more exuberant attitude of worship, displayed also in the statue and in the figures of the family carved on the back of the stela, is unusual in such a context, where the bent-armed pose of the reliefs on the sides is normal. Seated in the prow of the bark is the child Horus, i.e. the sun-god Re-Harakhti, newly born at dawn.³ Although one might be inclined to describe the scene as 'Ramesside', representations of the solar bark on private stelae go back at least to the beginning of the post-Amarna Period, when there was a new emphasis on the iconography of the afterlife.⁴ Certainly Amarna influence is suggested by the deeply incised and markedly convex solar symbol. Some convexity occurs in sun-disks of earlier periods, but is rarely so pronounced as on the Atenist monuments, where the same emphatic treatment is accorded also to other circular signs, and is often accompanied by a certain disproportion in size.⁵ These characteristics are to some extent present in the stela's inscription.

¹ The writer is grateful to Dr. I. E. S. Edwards and Mr. T. G. H. James of the Department of Egyptian Antiquities, British Museum, for their kind co-operation.

² See *Bull. Inst. Arch.* 4 (1964), 165 ff., pl. 12; *JEA* 53 (1967), 34 ff., pls. 3, 4.

³ Cf. Budge, E. A. W., *Papyrus of Ani* (London, 1913), pl. 19. Černý, J. *Egyptian Stelae in the Bankes Collection* (Oxford, 1958), pls. 1, 4. Sometimes the Horus-falcon is substituted, e.g. in Brit. Mus. 797: *Hieroglyphic Texts*, VII, pl. 36.

⁴ Davies, N. de G., *Tomb of Neferhotep* (New York, 1933), I, pl. 34. Baud, M. and Drioton, É., *Tombees thébaines: Le tombeau de Roy* (Cairo, 1928), 41 (not illust.).

⁵ E.g. Edwards, *op. cit.*, pl. 24.

The writing of the name Harakhti with two 'rising sun' ideograms (in the arch and in line 2 of the stela) is very uncommon outside the Amarna Period, when probably for ideological reasons they were substituted for the two oval 'sand-tracts'.⁶ On the stela there are also possible traces of an *ankh*-symbol suspended from each of the lower 'rising sun' ideograms as in some inscriptions of that period.⁷

Less conclusive in itself, but consistent with the other dating evidence, is the sculptural style of the figures with their heavy loins and (in the reliefs) gaunt, angular features with well-marked contours, both typical of the 'naturalistic' royal portraiture of the Amarna Period. The face of the statue has unfortunately been damaged.

Although the identity of Nakhtmin is unknown, a stela⁸ belonging to a scribe (no other titles are mentioned) of the same name and his wife Tuy (perhaps a short form of Muttuy),⁹ and dating to the beginning of Akhenaten's reign just after his change of name, is similar enough in style to be nearly contemporary. Both combine the Atenist features mentioned above with references to the older deities. The British Museum's statue may, therefore, belong either to the same period, when the traditional religion was not yet proscribed, but when the artistic innovations of the earlier Theban phase had already begun, or to the period just after the return to orthodoxy.

On the stela the short hymn and funerary prayer are in the traditional style with mention of 'the gods' besides the Atenist-favoured Re-Harakhti and Shu. Less conventional is the second of two funerary offering-formulae of which traces remain on one side of the plinth, the word which Edwards completes as '*pr* ('who provides'?) standing where one would expect to find the name of a deity. If, however, some distortion of the original sign were assumed, the word could be restored as 'Osiris', cf. Hayes, W. C., *The Scepter of Egypt*, II (Cambridge, Mass. 1959), 221, fig. 131.

Translation of the inscription on the stela.

The scribe, precedent¹ priest of Isis, and mayor Nakhtmin, justified, lord of reverence says, as he gives praise to Re-Harakhti: Hail, thou who shinest in the sky at every dawn, and wakest the gods in their temples and men in their towns. Thou art Re who fashioned the gods. When thou shinest, the

⁶ The change already occurs in the later part of the tomb of Ramose: see Davies, *Tomb of the Vizier Ramose* (London, 1941), pl. 33.

⁷ Sandman, M., *Texts from the time of Akhenaten* (Brussels, 1938), 144 (No. 138), 155 (No. 164), 157 (No. 168). No. 138 is the same item as that referred to in the footnote below.

⁸ Bissing, F. W. von in *ZfS* 64 (1929), 113 ff., Taf. 4. See also note 7 above. Anthes, R. in *Berliner Museen*, LV (1934), 95, Abb. 5 (Berlin 23718). The writer owes the last reference to Dr. R. L. B. Moss.

⁹ E.g. Gauthier, H., *Le livre des rois d'Égypte* (Cairo, 1907-17), III, 74 f.



1 Upper part of stela (scale 1/3 approx.)

2 Profile of statue (scale 1/5 approx.)

people live. Thou shinest on me, and hast caused my soul to live on earth. Thou preservest my body in the necropolis, and hast caused me to be among the blessed spirits . . . May I follow² thy spirit. Heaven is bright,³ which is raised up by Shu, while beholding⁴ the beauty of thy Majesty.

Thou art propitiated with fine words. If thy heart is satisfied with what he (*sic*) says, then thou shalt cause my soul to live forever—it will not die, my body enduring without its name being missing. Mayst thou grant me breath within the necropolis as a favour . . . (By the scribe), precedent priest of Isis, and mayor Nakhtmin, justified . . .

COMMENTARY (to be read in conjunction with Edwards, *op. cit.* 52).

¹ *Wb.* I, 283: 'der vorne geht.' Kees, H., *Das Priestertum im ägyptischen Staat* (Leyden, 1953), 20f.

² Cf. Sethe, *Urk.* IV, 445, line 4. The form of the *šms*-crook (i.e. without 'package') is unusual.

³ *Wb.* I, 424. Cf. Edwards, *op. cit.* 35, pl. 30.

⁴ The construction is probably *hr* (in lacuna) with the infinitive.

Outline of a stratigraphical “bridge” between the Mexico and Puebla basins

by I. W. CORNWALL

Introduction

The adjacent Basins of Mexico and Puebla lie at heights of over 2,000 m. in about 19°N latitude and, on the whole, between 98° and 99°W longitude.

This location is near the middle of the approximately east-west trending Volcanic Axis of the country and the Basins are separated from each other by the more or less north-south mountain range of the Sierra Nevada, which includes the two great snow-capped volcanoes, Popocatepetl and Iztaccíhuatl.

While that of Mexico, 2,240 m., is a true basin, having no natural drainage to any Ocean, the Basin of Puebla 2,162 m., at some time in the Pleistocene perhaps also having been totally enclosed, nowadays drains via the gorge of the Atoyac River into the Balsas valley to the south and thence into the Pacific Ocean, on the border between the states of Michoacán and Guerrero.

The Basin of Mexico has, until quite recent times, held a great lake, or series of lakes,¹ of which only the remnants of Lake Texcoco and, in wetter seasons, that of Chalco, at a slightly higher level, 2,269 m., remain to remind us of the extensive sheets of shallow open water which formerly existed. The modern (1947) dam at Valsequillo, on the R. Atoyac, holds back the Puebla drainage, flooding the valleys of the Atoyac and its affluents for a distance of some 17 km. upstream. Ancient lake-sediments, in places extending to heights considerably above the maximum water-level of the artificial lake, show that, here, too, there must have been large areas of standing water in the past, on the latest (Pleistocene) occasion dammed back by a lava-flow from the C. Colorado just above the modern dam.

These high basins and their lake-shores, under a warm-temperate continental climate, have long afforded desirable habitats for man. The modern cities from which they are named were preceded, in pre-Hispanic times, by important, if smaller, centres of population under the Aztec Empire and greater or lesser settlements and ceremonial sites flourished in numbers back through Classic and pre-Classic times.

¹ Mooser, F., White, S. E., Lorenzo, J.-L., *La Cuenca de México*, Instituto Nacional de Antropología e Historia, 1956, 57 pp.

Between these settled civilizations and the earliest known hunting and collecting cultures there is a long time-gap, which prehistoric studies have not yet filled. (They are a fairly recent development in a land where archaeological riches of later periods occur in such bewildering plenty.) The human prehistoric period nevertheless extends, so far as is yet known, from perhaps 20 thousand years B.P. up to the last few centuries before Christ, and is by far the longest of all in Mexican archaeology, even if, as yet, little known and very sparsely represented in our area by sites and recognizable archaeological materials.

There is, however, a number of known early-man sites of great interest in both Basins, located at, or near, the former shores and banks of lakes and streams, and so in direct stratigraphical connection with the natural geological deposits there being formed by these agencies in their times. Most past interest, both geological and archaeological, has therefore been devoted to their description and interpretation and comparatively little to what are certainly in part contemporary terrestrial, and strictly subaerial, geological phenomena, evidences of which are to be found at higher levels in their neighbourhood.

One serious difficulty has always been (and still remains), in that these higher-level deposits, almost exclusively volcanic in origin, have no evident stratigraphical connections with those of lakes and streams on the floors of the Basins, being separated from them on both flanks of the Sierra by thick alluvial-fan and mudflow deposits, produced at different times by scouring, washing and sludging of all materials exposed on the slopes above, and so presenting on the whole amorphous masses of heterogeneous origin, having little clear stratification themselves and effectively blanketing any well-stratified connecting deposits which may still exist beneath them.

Another difficulty is that of assigning reasonably well-founded dates to any of the deposits concerned, whether of mountain slopes or lake- and river-basins.

All these considerations were in mind when the writer paid a first visit to Mexico in 1960 and was able to see some of the field-evidence and consider some of the problems involved at first hand, with the help and under the guidance of Mexican colleagues, both archaeologists and geologists.

One observation, in particular, was made, which seemed to be of environmental importance. At several widely-separated points, there occurred, in road-cuttings, quarries and the natural sections presented by erosion-gullies, strikingly red-coloured materials, having the appearance of undisturbed weathering-soils developed at ancient land-surfaces, now buried by subsequent deposits. These were seen in often quite different stratigraphical contexts, yet, on more careful examination, the red beds were found to resemble one another very closely in general character and texture. It was further noted that nowhere in the part of the two Basins seen, or on the adjacent mountain slopes, did such

red materials occur in the soils forming at the surface under the present-day climate. These were generally of a blackish or brownish colour. All the notably red beds were more or less deeply buried, or, if at all exposed at the surface, were in situations where erosion and denudation were nowadays manifestly so active as to outpace the possible rate of soil-formation.

In view of this, it was concluded that if, indeed, the red materials were ancient soils, they must have been formed under environmental conditions very different from those of today and since, fundamentally, all the available parent materials consisted of similar volcanic products of predominantly basaltic or andesitic (i.e. basic or intermediate) mineral and chemical composition, the dominant environmental difference governing their colour and other characters must have been climatic. Further, very similar types of red soil seemed to have been formed, whatever the parent material, and wherever they occurred. This, also, pointed to dominance of the climatic factor, for, whereas the products of a single volcanic explosion may vary quite widely in particle-size, texture or colour, according to their position relative to the vent and the direction of the wind at the time of their ejection, a soil-type mainly dependent on climatic conditions would be essentially similar, with only very local minor variations, over the whole area subject to those conditions.

From this process of reasoning there emerged the consideration that, if these arguments were sound, the red soils ought to provide most valuable stratigraphical 'marker-horizons' over a wide area and enable firm correlations to be made within that area from one geological exposure to another, as well as indicating by their own qualities the kind of climatic conditions prevailing at the time of their formation.

On this first visit, no systematic fieldwork or sampling were possible, owing to preoccupation with other matters and lack of time, but on returning to England, the idea of the red soils as markers and environmental (indeed climatic) indicators was developed in a short paper,² in which the varied geological and environmental evidences bearing on the period of the earliest hunting inhabitants of the Mexico Basin were reviewed. A working hypothesis put forward at that time was that the red soils might prove to have been formed under wetter conditions than those now prevailing on the Mexican Plateau with a much richer vegetation-cover than at present. It was not then realized how many stratigraphically-distinct red soils would prove to be recognizable. As usual, a problem envisaged on the foundation of only a slight and brief acquaintance with the field evidence was considerably over-simplified!

Plans for a second visit to Mexico, in the company of Professor F. E. Zeuner made for the spring of 1964, came to nothing owing to his sudden death in

² Cornwall, I. W., 'Volcanoes, Lakes, Soils and Early Man in and near the Mexico Basin', *Man* (1962) 86, 55-8.

November 1963, but between January and March, 1966, inclusive, a somewhat modified programme of fieldwork was carried out, which is the subject of the present publication.

In the interval between the two visits, a new motorway had been constructed between Mexico and Puebla, crossing the pass over the Sierra Nevada at Río Frío on a much more direct, well graded and less tortuous course than the old road. Amongst other places, it was on the old Mexico-Puebla road that some good exposures of red soils had been noted during the 1960 visit. On a preliminary outing to Puebla in January 1966 it was clear that the motorway, cutting directly through spurs, instead of skirting them, would provide even more extensive and completer sections.

In addition to the obvious interest of the buried soils in the motorway sections, even a cursory inspection of these exposures showed that there were, interspersed with the main body of finer volcanic ashes and dusts, weathered or unweathered, some striking beds of coarser pumices. These represent fairly widespread deposits, due to the activity, at no great distance, of some very big volcanic vent or vents, emitting andesitic rather than basaltic materials. Not only did these pumices promise to be almost as valuable as stratigraphical markers (though probably more localized than) the weathering-soils, but their rather more acidic character than most of the local volcanics offered the possibility of their containing mineral crystals, such as biotite, and sanidine or other feldspars, having a potassium-content high enough to enable their radiometric dating by the Potassium/Argon method. Even this possibility was exciting, since we had no firm evidence hitherto for even an educated guess at the time-scale relating to these deposits.

As already noted, the succession of buried soils, pumices and relatively unweathered volcanic ash-deposits disappeared, on the lowest parts of both slopes of the Sierra, beneath more recent alluvial fans and mud-flows. The presence of the pumices, however, made it likely that the more recent of them at least would be represented among lacustrine sediments of the plains, beyond the furthest reach of the slope-deposits. In this case, if petrographic examination could be used to distinguish them from one another with reasonable confidence, the stratigraphical relationships between terrestrial and lake deposits might perhaps be established, despite the fact that their actual contacts, if any, were not accessible to inspection.

By good fortune, the Department of Prehistory of the Instituto Nacional de Antropología e Historia was, at the time of my arrival, already engaged in the excavation of a prehistoric lakeside site at Tlapacoya, under the direction of Mr. Michael and Mrs. Elizabeth Goodliffe. (Fig. 1) The excavation was located at the base of the Cerro de Tlapacoya, the ruin of a Tertiary lava-volcano, forming an island in the former Lake Chalco, no more than a few kilometres from the foothills of the Sierra and the road-cuttings referred to above. It

involved the digging of two long trenches to establish the stratigraphical relationship of the archaeological layers to the natural lake-sediments. In the sections of these trenches, and in others (Sites Z.I, II) near by, opened for non-archaeological purposes, there was found a whole series of pumice- and ash-layers, representing a relatively complete record of the larger volcanic events in the neighbourhood during the deposition of the lake-beds. Evidently there was here a good prospect that some of these pumice-layers were the result of explosions identical with those which had yielded the pumices in the road-cuttings. Whether any would prove to be individually correlatable was another matter, depending on their original mineral contents and state of preservation in the different conditions of sedimentation—under water and subaerially, respectively.

On the Puebla side of the Sierra Nevada there was also an archaeological site, some 10 km. to the south-east of the City, excavated in 1964 by Miss Cynthia Irwin. This was situated on the S. Baltazar Tetela Peninsula, at Hueyat-laco, close by the shore of the modern artificial Lake Valsequillo. (Fig. 1) So far as was known, no pumice deposits occurred here and, indeed, the site was so much further from the foot of the Sierra, to the east, than was Tlapacoya to the west, that demonstration of any stratigraphical connection between it and the volcanic deposits exposed in the motorway sections was much less likely to be clearly established. It was nevertheless felt to be worth while to attempt it, the possible outcome of success being a stratigraphical 'bridge' across the Sierra, tying the two archaeological sites into a single relative chronology. If, further, some absolute dates for details of the bridge could be obtained, whether from organic matter by Radiocarbon or from volcanic minerals by Potassium/Argon, some idea at least of the absolute, as well as the relative, antiquity of the human occupations might emerge—an objective well worth gaining, if it should prove possible.

An area opposite Hueyat-laco (Site X), near the neck of the peninsula, showed deep gully-erosion and so exposed good natural sections in the more superficial deposits mantling the hillside. This was another of the places where a strikingly red bed near the base of the exposures had been observed on my previous visit in 1960. It was thought that a search in these gullies for pumice-layers and buried soils might afford some means of correlating the general stratigraphy of Valsequillo with that of the motorway sections, despite the distance of about 12 km. between the gullies and the nearest point on the motorway, lying on the far side of the City of Puebla, to the north-west.

It had been hoped, originally, that the western edge of the Basin of Mexico, the foothills of the Sierra de las Cruces and the two roadways, old and new, leading up to a high pass, Puerto el Guarda, and descending beyond into the valley of Toluca, might provide a stratigraphy comparable to, and even correlatable with, that on the eastern side. A quick reconnaissance, however, showed

clearly that the deposits here are *not* comparable, being much older for the most part, and this conclusion was confirmed by Sr. Ir. Mooser, Chief Geologist of the Comisión Federal de Electricidad, my vulcanological adviser. It soon emerged that the problems of the Mexico-Puebla motorway and of its two appended archaeological sites would fully occupy the time available for field-work, so no further attention was devoted to the Toluca roads.

On the eastern side, again, some exploration was made of two parallel transects crossing the Sierra Nevada: that of the Texcoco-Calpulalpan road into the State of Tlaxcala, to the north of the motorway, and that of the Amecameca-Paso de Cortés-Cholula route (of which the greater part, to the east of the Paso, 3,580 m., cannot be dignified by the name of 'road', though successfully traversed one day in a four-wheel-drive Land-Rover!) The former area is studded with small, apparently young volcanic vents, of which it was seen that the complicated and very local emissions would need extensive (and, for the present purpose, irrelevant) geological mapping before any useful correlations would be possible. The latter, close to the great volcanoes, Popo. and Iztac., is so deeply mantled with their more recent ashes and pumice that materials comparable with those observed on the motorway are now buried and accessible only in deeply-cut stream-gullies. Two sites on the Mexico side, Sacromonte, near Amecameca, and Cocotitlán, a basaltic cinder-cone between Chalco and Tlalmanalco, much nearer to the motorway, showed successions of red soils and pumices, but these, being somewhat remote, were not closely studied. At the latter place they could be examined only through field-glasses, being near the top of the vertical face of a quarry and quite out of reach without the use of ropes or ladders.

Some good natural and artificial sections showing yellow ashes and pumices were also observed, in passing, in the lower foothills of the Sierra, above and below the village of S. Mateo Ozolco, west of Cholula. These have not yet been studied.

It must be emphasized that the observations recorded here are almost confined to a single, narrow line of the country concerned. Since the new motorway afforded so many magnificent and relatively fresh exposures, the time available was most usefully spent in studying them as thoroughly as possible. While natural sections to either side of this transect are unlikely to be as extensive, clean and as easily comprehended as most of those here described, they might well exhibit important details hitherto unseen and should, in the future, be sought and examined, for evidence supporting, or contradicting, the present observations. The work will have to be done almost entirely on foot (or with a donkey!) for the higher country is, in general, so broken as to be inaccessible to any but a fully-tracked vehicle—if not so closely wooded as to exclude even this! Preliminary air-survey from a helicopter at a low altitude would, in fact, probably be most profitable, saving much unproductive footslogging in search of worthwhile exposures.

By the end of March 1966, a considerable number of the motorway sections had been sampled and studied. On returning to England, a preliminary description of the more important and characteristic of these was completed and some tentative correlations suggested, though admittedly the connections between the two terminal archaeological lakeside sites and the main part of the stratigraphical transect remained tenuous. It was here that it was hoped that the laboratory investigations would provide some reliable links.

The first laboratory results to become available were a pair of Radiocarbon dates, determined by Geochron Inc., New York. The first was for a lake-sediment from Tlapacoya with a high content of organic matter, the other a sample of carbonized coniferous timber from deposits of a *nuée ardente*, which was manifestly near the summit of the composite stratigraphical column given by the motorway sections. The former ($12,900 \pm 400$ years B.P. (GXO 646)) was close to the expected age for a Mexico-Basin hunter-fisher prehistoric settlement, if a little older than those previously known. The latter, on the contrary, brought a serious shock to expectations. A date of 'more than 35,000 years B.P.' (GXO 645) for a sample standing so relatively high in the stratigraphical sequence necessitated a complete re-casting of ideas hitherto held about the likely age of the deposits in the motorway sections. The date in fact emerging was impossible to fault on any theoretical grounds: the sample was plentiful, undoubtedly *in situ* and uncontaminated and consisted of pure carbon. A date of 35,000 years+ is, in any case a limiting result. It means, in effect, that the residual radioactivity of the sample is so low as not to give any reliable count of emanations due to radio-carbon in comparison with those due to the background. In fact, therefore, the sample might be of any age greater than this limit.

In view of this, it was clear that the red soils and the intercalated pumices, to which chief attention had so far been devoted, must be very much older than had been supposed, and so long antedate the hitherto known appearance of man in the Americas. The chief reason for considering them, *a priori*, to be comparatively young was the fact that, in every section seen, the beds concerned were closely conformable to the present-day slopes and topography, being 'draped' over ridges and valleys alike. The main dissection of the landscape, therefore, must have been antecedent to their deposition and, in view of the radiocarbon date, the topography of the lower slopes of the Sierra must thus be considered to be very ancient indeed.

It became imperative, therefore, if any progress were to be made with the original project, to find correlatable levels in the uppermost parts of the sub-aerial deposits, i.e. those overlying the horizon of the *nuée ardente*.

Having, in any case, to be in Canada for a conference in November, 1966, the writer therefore paid a visit of a week to Mexico and, with the help in the field of several colleagues, a series of manifestly later volcanic phenomena, falls of characteristic ashes and pumices, was found lying above the *nuée* horizon on both flanks of the Sierra. These seem possibly to afford the required links at levels comparable in age with the archaeological remains.

The Mexico-Puebla motorway sections

The new Mexico-Puebla motorway branches off from the old Puebla road about 1 km. to the west of the township of Los Reyes, on the latter road. This is the point from which the kilometre distances are measured. It rises at once slightly from the Lake Texcoco plain to skirt the base of the striking tuff-cone, La Caldera, with its twin craters, and drops down again beyond to the Lake Chalco level. From here it strikes straight across the plain towards the Cerro de Tlapacoya, near which branches off the road to Chalco town (km. 14.5). At Tlapacoya, the motorway bends half left and makes straight for the pass, marked on the skyline ahead by the prominent, pine-clad, hemispherical lava-dome of C. Papayo.

Just beyond the point where the motorway begins to climb from the level plain of Lake Chalco (km. 15), there is an exposure in a pit on the left of apparently horizontally-bedded material, generally reddish-brown in colour. The surface of this stands some 4–5 m. above the lake-plain, but seems to show neither pumices nor intercalated lacustrine sediments, as had been hoped. The deposits appear to be alluvial-fan and slope-washed materials, truncated by the longitudinal section of the pit almost at right-angles to the slope, and so appearing to lie horizontally. These probably overlie and conceal the junction of the ashes and weathering soils (presently to be described) with the lake-sediments. Water standing (Jan. 1966) in the bottom of the pit is probably close to the general level of the water-table in the Chalco Basin, less than 1 m. below the surface on the level plain, as could be seen in drainage-canals.

The motorway rises gently and the first few shallow cuttings expose only brownish slope-washed soil-materials. At about km. 23, however, two deeper cuttings, made to grade the road, show a well-marked buried soil of a red colour and, at road-level, beneath a thick bed of relatively unweathered fine greyish-yellow ash, a layer of fresh-looking unweathered pumice of coarse-sand grade.

The sections in the cuttings seem, at first sight, to be uniformly pink or red in colour. This is due to a film of rain-washed material, chiefly derived from the various red soils to be described, which are more easily eroded by heavy rain than the beds of relatively unweathered fine, compact volcanic sediments. Some textural detail and almost all colour-distinctions between strata are thus obscured. Only a newly-cleaned face permits accurate observation and description. Owing to their greater erodibility, however, the weathering-soils are themselves distinguishable at a glance by their characteristic 'columnar' structure after some rain-erosion.

Beyond, we come to deeper and deeper cuttings, which truncate spurs of the foothills, exposing in depth more and more layers of fine, ashy volcanic deposits interspersed with pumice-layers and more well-developed weathering surfaces. These will be described below in more detail, site by site; the important point here is a matter of geomorphology and applies to all equally.



Figure 1

The spurs have rounded outlines and it is notable that the beds exposed below nearly always faithfully follow the surface contours, scarcely varying in thickness, at least in any one cutting. Their boundaries, and the soils surmounting them, therefore, generally describe concentric arcs conformable to the topography.

This can have only one meaning: that the materials represent uniformly-distributed air-falls of ash or pumice, on the whole subsequently undisturbed, deposited on a land-surface already dissected by the present main valleys and gullies—i.e. are subsequent in time of deposition to the cutting of those valleys. Dr. H. E. Malde, an U.S. geologist working at the same time as the writer in the Puebla valley, vividly described this phenomenon as the volcanic deposits being 'draped' over the topography.

The main reason for abandoning further inquiry on the Sierra de las Cruces deposits, to the west of the Mexico Basin, was that, here, the associated volcanics were *not* conformable to the topography, being horizontal, tilted or otherwise disposed in ways quite unrelated to the forms of the present spurs and valleys. In one case, for instance, a deep ancient cut-and-filled erosion-gully was seen, in a road-section, to occupy the very summit of such a spur—a position where its formation was obviously quite impossible since the development of the present topography. All these volcanic sediments were, thus, clearly much older than the main valley-cutting, which one may justifiably assume to have been simultaneous on the two sides of the same Basin.

The conformability to the present topography of the subaerial volcanic sediments in the motorway-cuttings led to the conclusion, now seen to be erroneous, that this topography could not be so very ancient.

The radiocarbon date of 35,000 years+B.P. for a deposit stratigraphically younger than any of them now shows this conclusion to be mistaken. By comparison with what we know in England, where (of course under totally different climatic conditions) the topography has changed out of all recognition within the last 0.25 million years, even this looks astonishingly stable.

Though, in comparison with spans of geological time, the accumulation of such homogenous beds of airborne volcanic sediments is essentially instantaneous—a matter of hours or, at the outside, of a few days or weeks, the development at their surfaces, before the succeeding volcanic events, of mature-looking weathering-soils often a metre or more in thickness, is, even under tropical conditions, a very slow process—taking at least some centuries or even millennia. The passage of time shown by the radiocarbon date must, therefore be in great part correspondent to long periods of volcanic quiescence and subaerial weathering.

Description of Sites

Sites A and B (km. 23.0–23.5) (Fig. 2). These are sections in two adjacent small cuttings, in which, because they are not very deep, the uppermost deposits and modern soil were easily reachable for examination and sampling.

The uppermost 2.0 m. include the modern soil (grey-black and sandy), now often eroded, formed on a bed of somewhat weathered brownish yellow fine ash. Beneath this again is just over 1.0 m. of distinctly more weathered brown material of the same sort, probably a soil, of which the summit is about 2.0 m. from the modern surface ('b.s.' = 'below surface'). The lowest part of this shows discontinuous wavy bands and zones, up to 2 cms. thick, of secondary calcium carbonate (locally called 'caliche') which seems to have infiltrated from above. It occurs very constantly within this superficial zone (wherever preserved) in all the sections—and nowhere else in any of them. This is a very striking fact, indicating that only modern, or quite recent, conditions have been favourable to its formation. It suggests fairly intense chemical weathering of calcium-feldspars and glasses, the main sources of calcium in such volcanic materials, but with precipitation insufficient to wash it (as in perennially-moist climates) right out of the profile, so that it is lost in the drainage. It is thought to correspond to conditions like those of the modern climate, which provides adequate summer rainfall but a 6-months' almost unbroken dry season, during which the soil dries out by capillarity and evaporation to a considerable depth.

Just over 3.0 m. b.s. is the summit of a markedly red soil, called here 'First red soil' (counting from the top of the section). This is a very constant and easily recognizable reference-horizon in most sections. Very red close to its surface, the intensity of weathering falls off with depth, but is perceptible to the naked eye for nearly 2.0 m. Its parent material is a very thick, massive and unstratified deposit of yellow-buff, dense, fine volcanic ash, nearly 7.0 metres in thickness, including the soil. Such ashes generally prove to be of basaltic composition and so may be the products of any of the numerous young basaltic vents not far away.

The continuity of this ash is broken in three places (6.5 m., 7.25 m. and 10.0 m. b.s.) by distinct beds of very fresh-looking pale grey or white pumice. The uppermost and lowermost of these beds are thin (20–30 cms.), but relatively coarse (fine to medium gravel) in grade, with lapilli up to 4 cms. in maximum dimension, a high percentage being over 1 cm., while that in the middle is about 40 cms. thick, but of much finer grade, mostly medium-sand with a few particles up to 2 mm. in diameter. These pumices are probably andesitic in composition, i.e. as rocks, 'intermediate' in the petrological classification. This being so, they are unlikely to have issued from the same vent as the basaltic ash, with which they are interbedded. It seems, indeed, that only the very largest volcanoes (in this case Popo., 5,450 m. or the Head of Iztac., 5,146 m.) have emitted andesitic materials and, because these vents are very high, the resulting

OUTLINE OF A STRATIGRAPHICAL "BRIDGE"

pumices are very widespread. It would seem, therefore, as if the three pumice-beds here recorded represent three distinct explosions, probably from the same andesite vent, interspersed with basaltic ash being simultaneously, but intermittently, thrown up by a local basalt-volcano. The whole 7.0 m. of deposits need not have taken long to form and there is no evidence in this section of an appreciable pause which might have allowed soil-formation to begin on an exposed fresh surface at any intermediate point below the 'first red soil' (but compare Site M below). This, formed at its summit, evidently represents a relatively long period of volcanic quiescence at the end of this phase of deposition.

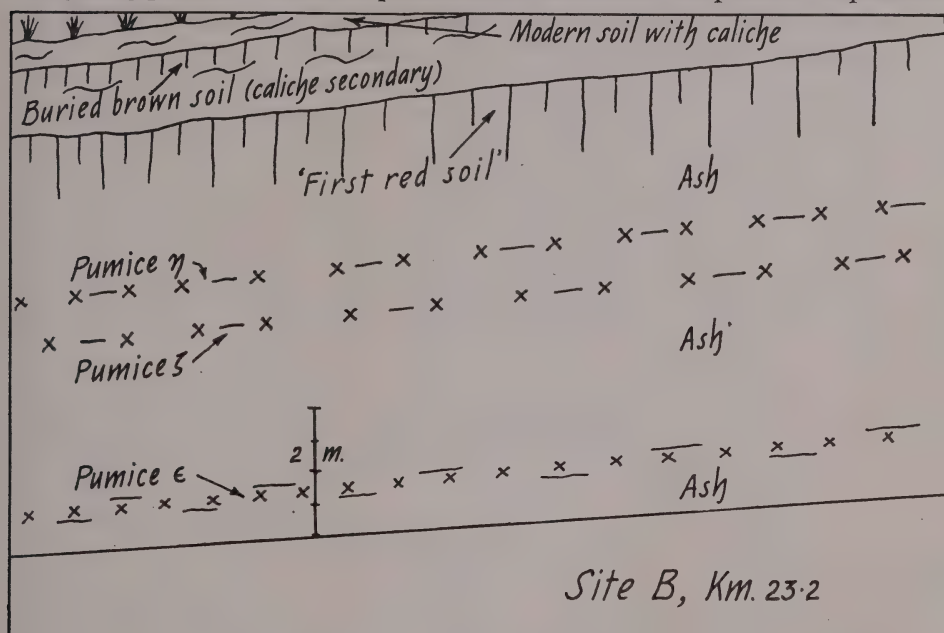


Figure 2

At Site B, the lowest of the three pumices rests, at about 10 m. *b.s.*, on a bed of disturbed brownish material, just over 50 cms. thick, overlying some 40 cms. of relatively fresh-looking greyish-yellow ash, of which the surface is irregular and manifestly eroded. The brown material itself consists essentially of the same ash, but is cross-bedded and mixed with stones and derived pumice lapilli. It thus seems to be the remains of somewhat weathered soil, eroded and washed down the slope. Here, it is clearly not *in situ*, but derived. At Site G (below) the evidently corresponding pumice rests on the uneroded surface of a brownish-yellow stoneless weathering-soil.

Site C (km. 25.0). This section occupies the outer arc of a (for the motorway) sharpish curve and, unlike all the other cuttings, the walls of which are nearly

vertical, or only slightly 'battered', here it has been cut back at a slope of between 30° and 45° . While this is, in one respect, a disadvantage for the geologist, in that some material, eroded and washed from above, comes to rest, at least temporarily, on its surface, it helps him considerably in another, because the entire exposure is accessible by scrambling, without undue hazard. At the same time, the angle at which the beds are cut by this sloping face makes their direct measurement difficult. The section was thus used mainly to check the stratigraphical details already recorded down to this point. It did, however, expose somewhat deeper beds than Site B, in particular, a still more striking dark red soil underlying the thick ash-bed which was the deepest layer exposed at Site B. This red soil is hereafter described as the 'marker-soil'

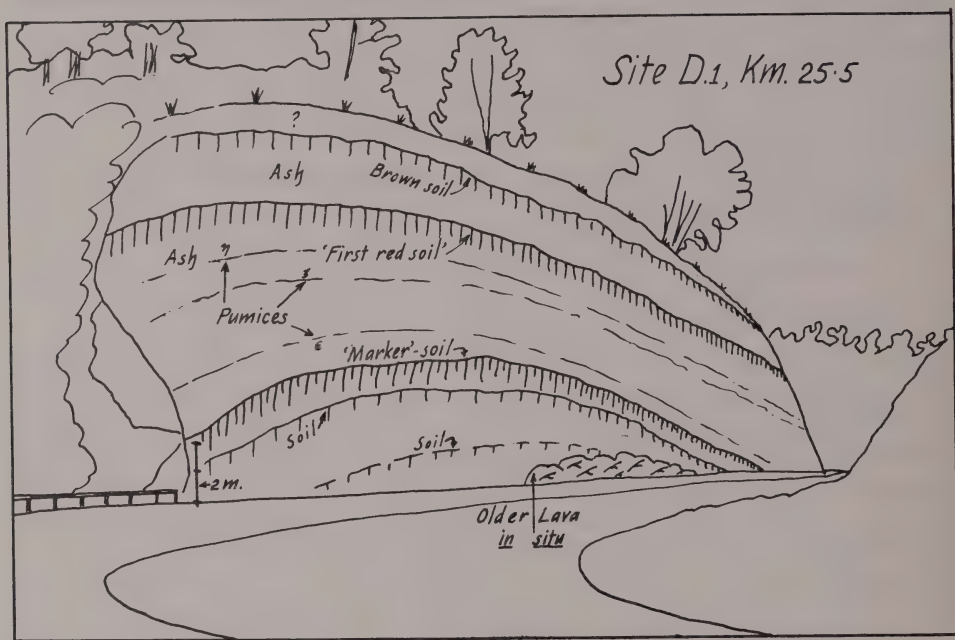


Figure 3

Site D (km. 25.5) (Fig. 3). This very fine exposure, some 500 m. uphill from Site C, displayed a quarter-moon section through a spur of evenly-rounded outline, the road-surface forming the chord of the arc. Even as seen from Site C, the 'first red soil', high up in the section, and the 'marker-soil' could easily be recognised with the naked eye, both following the surface-contours in smooth arcs. At the highest point of that described by the 'marker', about 7 m. of deposits, hitherto unseen, were exposed below it.

The 'marker-soil' is worthy of some particular attention. Not only does it divide the composite geological column, derived from all the road-cutting sites,

into approximately equal halves, but it shows in the most accentuated form the characters, seemingly shared in some degree by all the red soils here described. More than any of them, it is subject to the characteristic erosion by uneven drip and trickle of rain on a not quite vertical cutting face, whereby any fine-grained, slightly less coherent layer than its surroundings is carved into vertical residual 'columns', separated by deep grooves or flutes where the trickling water is preferentially directed by any irregularity of the face of the cutting. Its summit, therefore, tends to be undercut by rain and, in a strong light, casts a deep shadow which may be seen from far away. The process of weathering which it has undergone seems to have removed some cementing materials, leaving a sandy, much less coherent, residue which, in conformity with the intensity of its weathering, is more or less deeply 'etched', by rain-washing, into these 'columns' on the originally practically plane surface of the cutting. The 'marker-soil', more intensely weathered than the rest, has a characteristic pinkish, almost purple, tinge at its very summit, by which it may be distinguished from the rest of its kind in an incomplete section, where there might, otherwise be, some doubt as to its identity. For the rest, it is of a deep, coppery red for the first 0.5 m. of its depth. Below the strongly weathered zone, its parent material is a compact, yellow buff fine ash, extending in depth for another 1.5 m., to a total distance (based on previous, not necessarily maximum, measurements) of just over 13 m. *b.s.*

At 13.1 m. is another, less intensely weathered, red soil-surface. With its parent yellow ash it measures almost exactly 1.5 m. and is then succeeded (still working downwards) by yet a third, at 14.65 m. *b.s.*, this and its similar parent measuring exactly 1.0 m.

From here on down there are less distinct traces of two other soil-surfaces, at about 15.6 m. and 17.6 m. *b.s.* The last immediately overlies a tumble of deeply-weathered lava blocks, about 0.5 m. in diameter, which, as a result of spheroidal decomposition of their surfaces, look like rounded boulders. This lava reappears in the next section (Site E), where it is clearly *in situ* and is covered by a more detailed stratigraphical sequence, leading up to the fourth red soil (counting from the top of the column) at 14.65 m. *b.s.* The section at Site D is evidently deficient in its lower part.

Site E (km. 26) (Fig. 4). Working down from the fourth red soil, with its surface at 14.65 m. *b.s.*, formed on a hard, compact parent-bed of yellow ash nearly 2 m. in thickness, we come to three pumice-layers within the space of the next 2.0 m. The two upper members of this group are not very clear, being fairly thin (25 cm.) and much mixed with the yellow ash in which they are embedded. The third is fully 50 cm. thick, purer and markedly coarser in grade towards its base. Even on a carefully-cleaned section, these pumices are not easily distinguished by eye, but in very oblique sun, at the right time of day (10-11 a.m.) they stand out fairly distinctly on the rain-washed surface of the cutting by their

slightly more granular surface-texture. Observed thus, it can be seen that they are of very even thickness and run without interruption across the section, so that there is no question of their being derived surface-washes, as was at first supposed: they are true air-fall pumices and their mixture with the fine ash presumably means that the different eruptions to which these two components are due were more or less simultaneous. Each appears to rest on a somewhat weathered surface, of which the lowermost is best marked—a distinctly clayey brown soil—at 13.5 m. *b.s.*

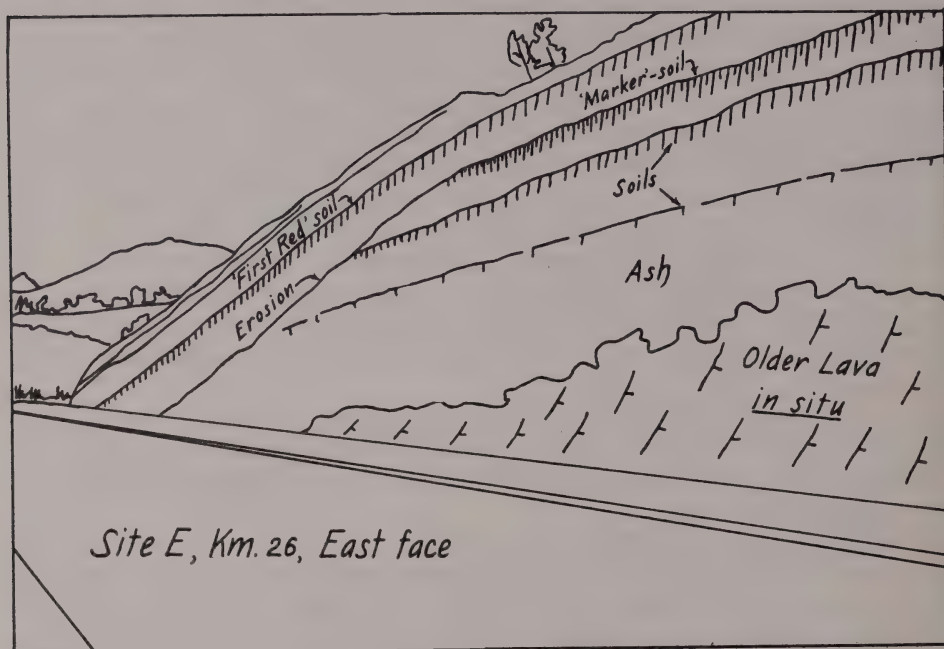


Figure 4

Two more, rather better-developed red soils occur beneath this, in one place, where measured, at about 19.5 m. and 20.5 m., respectively. On the opposite face of the same cutting, however, they appear at 20 m. and 23 m., respectively and in yet another part of the cutting they nearly coalesce close above the basal lava. They are generally separated from this by nearly 4 m. of unweathered fine yellow ash.

At the base of the Site E section is a lava-flow *in situ*, on the surface of which, and entering crevices in it, lies yet another coarse pumice, at about 24.5 m. *b.s.* in the composite geological column.

As already suggested, Site E shows evidence of erosion, and the best example of this is seen on the left side of the cutting (facing uphill) and towards

OUTLINE OF A STRATIGRAPHICAL "BRIDGE"

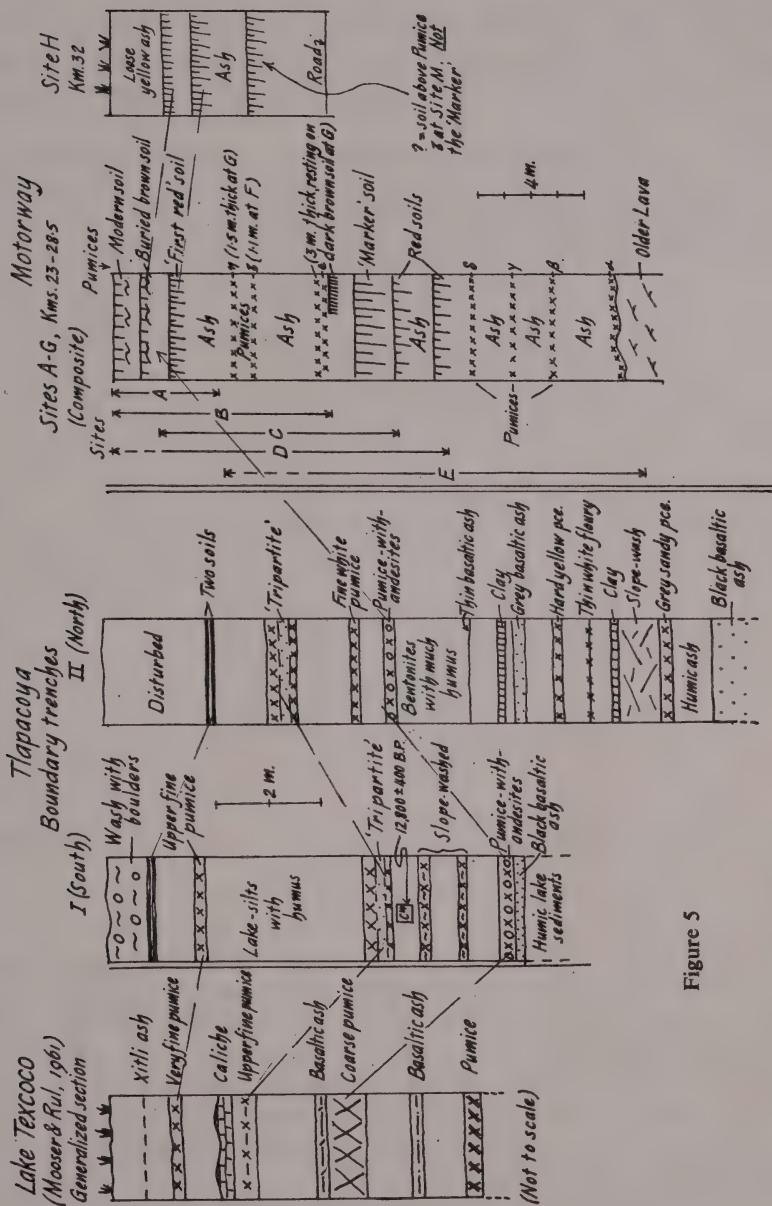


Figure 5

its lower end, where an erosion-surface on the steep side of the spur cuts through the 'marker-soil' and all the beds below it down to road-level, i.e. almost to the level of the basal lava. The strata and soils *above* the 'marker', however, though here lying unconformably on the earlier deposits, conform perfectly to the new topography created by the erosion, steep as is the slope on which they lie (Fig. 4).

The lava at Site E represents the deepest stratum exposed in any of the road-cuttings. Working up from this base, in chronological order as the beds were formed, we thus have to date the following sequence, the pumices, for purposes of later identification, now being given a Greek letter each.

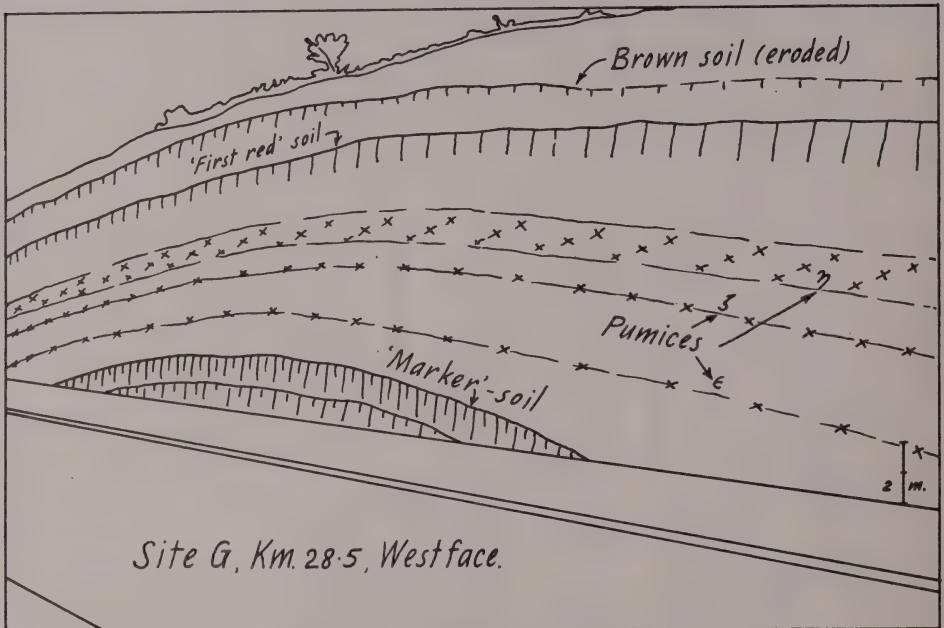


Figure 6

The Older Lava and a pumice on it (α) some 6 m. of fine ash, with three distinct pauses in deposition represented by soils, another (coarse) pumice (β), 1 m. of ash, a third pumice (γ), 1 m. of ash and a fourth pumice (δ).

Two m. of ash follow, surmounted by the lowest of a trio of soils at approximately 2-m. intervals, of which the third (upwards) is the 'marker-soil'. Above the 'marker' we have 7 m. of ash, including three more pumices in its lower part (ϵ , ζ , η) and another well-developed red soil at its summit (the 'first red soil'—from the top). Capping all are 3 m. or so of more or less weathered ash with the modern soil at their summit and 'caliche'-veins just above their base. The complete column thus described amounts, in all, to 26 m. (as mea-

sured—not necessarily maxima) of subaerial deposits. Though thicknesses are on the whole very constant in any one section, the various beds *do* differ in thickness from place to place. The thicknesses here recorded are those where the deposit in question was first seen typically exposed or was first accessible. In view of their variability, no great accuracy in recording their dimensions was aimed at. (See composite column, Fig. 5.)

Continuing up the motorway, the succeeding cuttings very satisfactorily confirm the stratigraphy already seen, with some modifications in detail.

Site F (km. 27.2). This shows Pumice ζ increasing from about 0.5 m. at Site E to 1.1 m. in thickness. It here includes andesite fragments up to 4 cm. in maximum dimension. Pumice η , too is thicker here (1.5 m.).

Site G (km. 28.5) (Fig. 6). Here, Pumice ϵ has thickened to over 3.0 m. and shows complicated variations in grain-size, from the finest floury material up to biggish lapilli, with beautifully sharp bedding. This thickening uphill and diversifying of the three pumices above the 'marker' seems to indicate that we are, here, approaching the vent or vents from which they were emitted. In the absence of evidence of weathering separating them, but only beds of fresh ash (of basaltic composition, rather than the andesitic character of the pumices), it would seem that at least two different vents were intermittently active at about the same time. It seems most probable that all three pumices, here, emanate from the same vent, representing three different phases of activity fairly close together in time. The rapid increase in thickness uphill of all three of these pumices, makes it probable that their source is rather the Head of Iztac. than Popo., since it is closer to our sites by about 18 km. It is quite possible, on the other hand, that none of the known andesite vents is the source of our pumices, but one or more which are now buried beneath the lava-flows of Papayo. These younger lavas cover everything along the motorway almost down to the lower margin of the pine-forest.

Site H (km. 32). This is the last motorway cutting on the way up to the pass which displays red soils. It is not a very deep section and shows nothing new about the soils or the pumices. It is, however, notably eroded above, almost down to the surface of the 'first red soil', having no representative of the rather compact later deposits and secondary caliche, generally present in previous sections. Instead, it has a homogeneous cover, up to 3 m. thick, of young-looking ash, not previously seen, weathering grey on the three-year-old surface of the section, which, when cleaned, is found to be incoherent, dusty and really of a fresh yellow colour. Though featureless and undifferentiated at this point, it is within this bed of incoherent fresh-looking ash that we must seek for traces of the *nuée* and subsequent volcanic events, which may serve as links in the post-35,000 years B.P. succession. Site H is separated from the next cutting uphill by a shallow valley. A drainage-trench cut in this valley and culverted under the roadway showed nothing but the yellow ash just referred to. The next cutting,

rather surprisingly, exposes only lava, capped by the same, and this continues, in succeeding cuttings, to the summit of the pass, with no further sign of red soils over the lava. This lava is nowhere as weathered and decayed as is that ('Older Lava') outcropping below the red soils at Sites D and E, and, though the presumed contact above Site H is hidden by the loose yellow ash, it is now clear that the lava overlies the whole sequence of ash, pumices and soils. It is here called the 'Younger Lava' though it is undoubtedly complex and not either all one flow or even necessarily all from the same vent (Fig. 7).

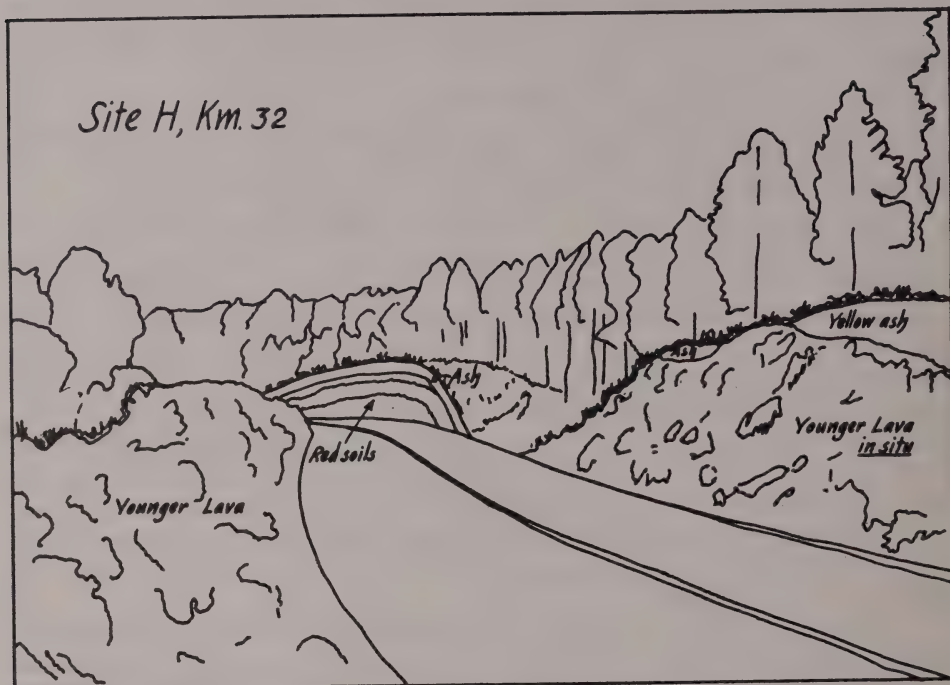


Figure 7

Proceeding uphill, the motorway cuttings expose members of this 'Younger Lava' complex, which is presumed to emanate from the nearest and youngest lava-dome, called El Papayo, situated just to the south of Río Frío, a small township close beyond, but somewhat lower than, the highest point (3,200 m.) of the pass. Wherever the lavas have any cover, it mainly consists of the same yellow incoherent ash first noted from Site H, with occasional pumices.

Towards Río Frío, one of these thickens notably in the road-sections and at the point (km. 45.5) where a side-road leads off to the Río Frío service-area, there is a deep quarry on the right (going eastwards) in which the nature of the pumice is made clear—it represents only the fringes of a tremendous mainly

pumiceous, *nuée ardente* deposit, which entirely fills a former side-valley here to a depth of 10 m. or more (for its base is not exposed in the quarry). The *nuée* is clearly subsequent to the lava and the yellow ash later yet—representing the most recent series of geological events hereabouts, now called by the name Río Frío Series.

THE 'RIO FRÍO' SERIES (Fig. 8)

The C¹⁴ date for the *nuée ardente* at Río Frío shows that the correlatives of the pumices closely associated with the early-man site at Tlapacoya must be much later than the *nuée*, and so be found, if at all, overlying it and the immediately underlying Younger Lava.

A search was therefore made in the motorway sections, beyond Site H (km. 32), at which the Younger Lava first appears to cover the red-soil series described above.

R.F.I. The most complete succession found hitherto is at km. 36.95, on the right-hand side, going eastwards.

Here, a medium-sandy loose grey pumice, about 30 cms. thick and containing quartzes, immediately overlaid the lava and was identified with the *nuée* (Pumice θ) since that occupies the same position at the type-exposure opposite the township of Río Frío. Above this, within three metres, occur three very fine white pumice-layers, none more than 5 cm. thick, interspersed with layers of silty ash. Higher again is a bed, some 2 m. thick, of fresh, loose yellow ash, already noticed at Site H and onwards, and this is capped by a coarse (fine-to-medium gravelly—2.0 to 20 mm.) pumice with plentiful fragments of three kinds of andesite-rock—blue, black and white—up to about 20 mm. in diameter. This very characteristic deposit closely resembles that seen in all four Tlapacoya sections, in those overlying 3 cms. of dark grey sandy basaltic ash. This pumice-with-andesites we label ' κ ', the letter ' ι ' standing for the 1–3 thin fine pumices, here and elsewhere intervening between the pumice-with-andesites and the *nuée*. The latter is covered by more fine ash, more or less slope-washed, on which is developed the modern, dark brown to black, forest soil. Pumice θ alone reappears at km. 34.8.

R.F. II. At km. 37.2, on the same side of the roadway, the above section is repeated, save that only two of the ι pumices appear, the upper much weathered and stained, by humic percolation from the modern soil, to a pale coffee-colour. The κ pumice is here similarly stained. The dimensions of these sections (Fig. 8) are not exactly to scale, having only been sketched, not measured.

R.F. III. Close to Río Frío, at km. 45, the pumices and ashes overlying the Younger Lava are well represented. Pumice θ , a well-bedded coarse sandy deposit, at this short distance from the main body of the *nuée* is a good 50 cm. thick. Two fine white pumices (ι) succeed it at short intervals, with clean yellow

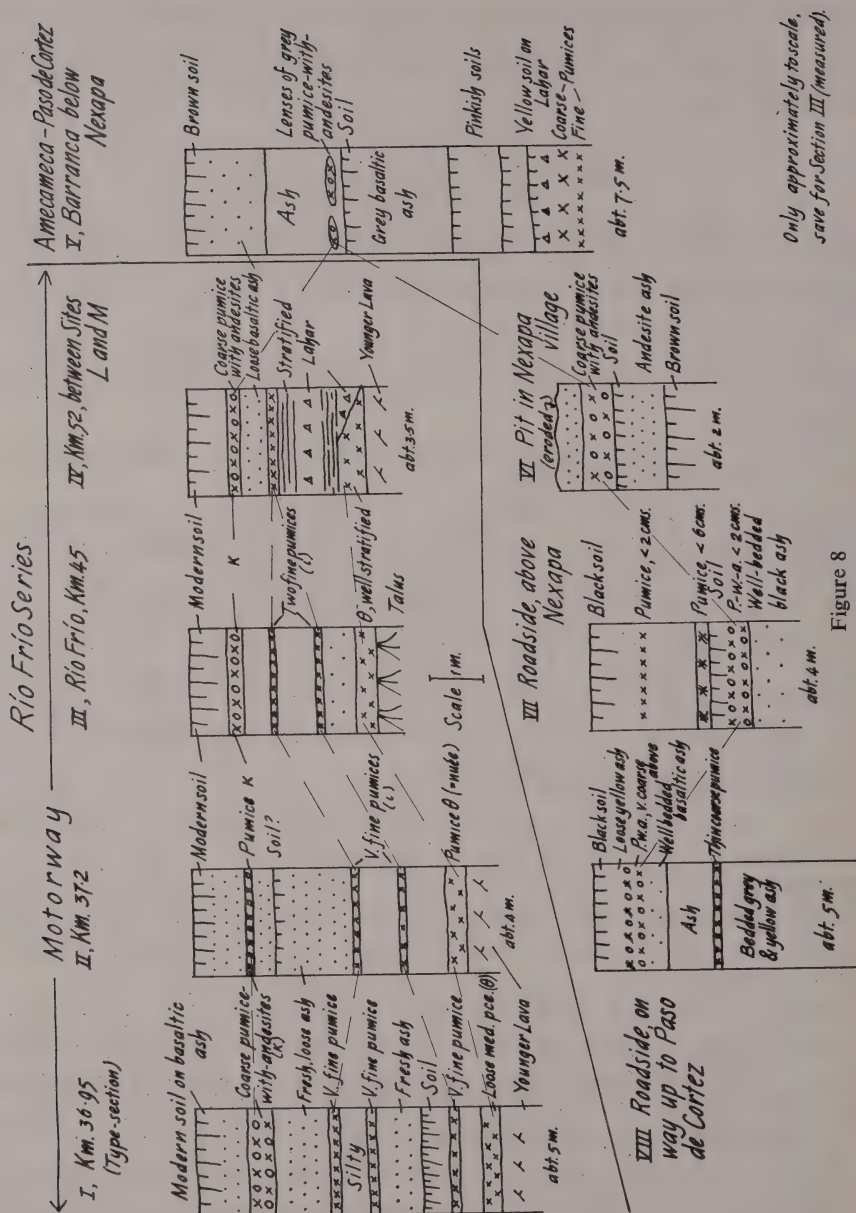


Figure 8

OUTLINE OF A STRATIGRAPHICAL "BRIDGE"

ash between, and 50 cm. below the modern soil there is 25 cm. of Pumice κ , the coarse pumice-with-andesites, which, here too, is stained yellow by the humus-percolation (Fig. 9).

R.F. IV. The section, at km. 52, between Sites L and M, beyond Río Frío, shows the *nuée ardente*, θ , lying direct on the Younger Lava, this being the last appearance of the latter as we descend the eastern slope of the Sierra. At one place, the upper part of Pumice θ is eroded and a lahar deposit with large cobbles of lava here overlies it. Elsewhere a derived and stratified slope-wash, followed by more lahar and a second stratified bed, lie direct on the undenuded surface of the pumice. A single fine white pumice (ι) follows, covered by loose yellow basaltic ash and the coarse pumice-with-andesites lies just below the modern soil.

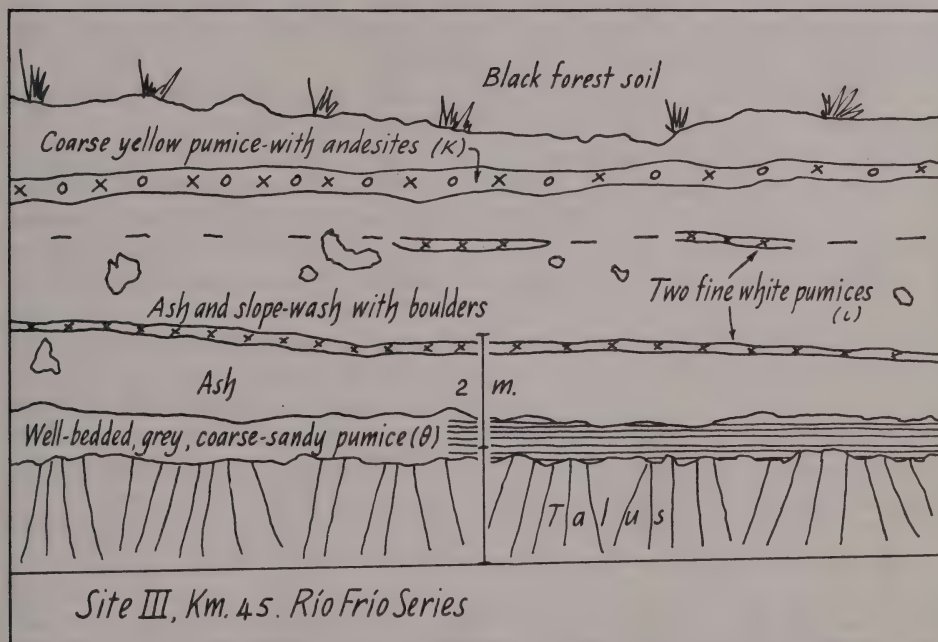


Figure 9

The sequence of pumices in the Río Frío Series is, so far, extremely consistent, if not always complete, whatever the intervening deposits.

A day was next spent along the road between Amecameca and the Paso de Cortés, to trace these latest pumices along a roughly parallel transect on the western slope of the Sierra.

R.F. V. Below the village of Nexapa a wide and deep *barranca* was explored, lying on the north side of the road. Sections here showed mainly derived, water-

laid and recent-looking deposits, none of which seemed to be in its original position. Among them were some lenses of a pumice-with-andesites which it would be hazardous to equate with the typical deposits described above. Nothing else in the upper parts of the sections looked at all like the pumices we sought, but in one place, beneath a yellow weathered ash and some mud-flow material, we found two pumices—one very fine and white, the other, above it, coarser, which seemed more likely to represent Pumices ι and κ respectively, of the motorway sections. They at least appeared to be *in situ*.

R.F. VI. In the middle of Nexapa village, a small exposure on the left showed well-bedded pyroclastics obviously *in situ*. On a brown buried soil lay a bed of grey andesitic ash, very fine in its middle part, capped by a further slight weathering. On this were a few cms. of coarse pumice-with-andesites, directly covered by a powdery, grey bedded ash. Both its qualitative features and its stratigraphical relations leave little doubt that this is our Pumice κ. The section was evidently beheaded and incomplete.

R.F. VIII. At several exposures in the road-bank above Nexapa, the following sequence, not invariably complete, was repeatedly observed.

On a layer of black basaltic ash, of which the base was unseen, but in places was at least several metres thick, lay a typical grey coarse pumice-with-andesites to a depth of some 50 cm. We had no hesitation in recognizing and equating this with our Pumice κ. It was followed by a small bed of yellow ash which, at one exposure, had a thin black soil at its summit. The soil was covered by an extraordinarily coarse explosion-deposit, with fist-sized masses of pumice and andesite stones, evidently the product of a shortly succeeding powerful explosion, the coarser deposits of which had not travelled far from the vent, plainly no other than that of Popo. itself. Some smaller lapilli, between 2 and 4 cm. in diameter, formed a distinct layer below the steeply sloping forested surface. The best section was more than 4 m. in height, all the materials subaerial and *in situ* and all, with very little doubt, to be assigned to Popo.

A further brief survey on the Puebla side of the Paso de Cortés was carried out from Huejotzingo, uphill. The characteristic coarse Pumice κ was noted *in situ* in many shallow sections, in all cases lying on a more or less thick bed of black basaltic ash and covered by a varying thickness of the loose yellow ash which is the immediate parent-material, in the region, of the modern soils.

On the same expedition, several very deep, almost vertical-sided *barrancas* were seen, one exposing more than 100 m. of bedded pyroclastic deposits with numerous intervening weathering horizons. These sections doubtless show in their more superficial parts the correlatives of the materials described from the motorway sections. Their deeper layers are plainly many times as ancient yet. Though, in view of the C^{14} date for the Río Frío *nuée ardente*, the greater part of the potential information from these sections must be irrelevant to the present problem, the *barranca*-exposures hold out hopes of yielding a complete

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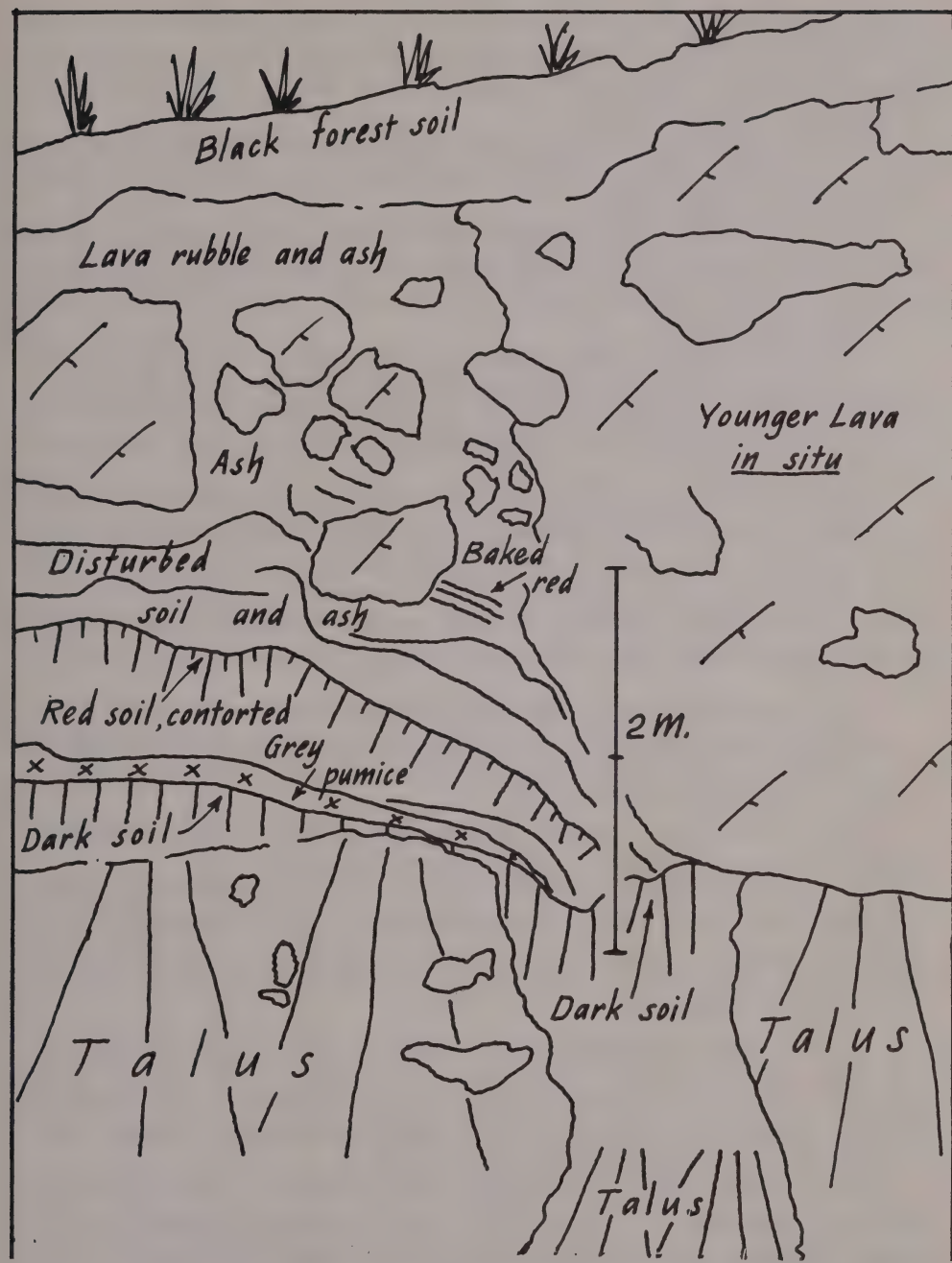


Figure 10 Site I Km. 48.5

relative chronology of the Pleistocene, perhaps some spot-dates for earlier samples by the Potassium Argon method and may even afford a stratigraphical datum for the Plio-Pleistocene boundary, which, though badly needed, has hitherto been lacking in Mexico.

At this point, time ran out for the writer, who had to return to London before any reliable connection could be established between the Río Frío Series and the further Puebla deposits.

Laboratory work on the samples already taken goes forward, both in Mexico and in London, and it is hoped that more fieldwork may be possible in the not too distant future, to clarify the many outstanding problems and uncertainties of this work.

A radiometric date for the *nuée* has now been obtained. On 22nd January 1966, we found tree-trunks *in situ* in the Río Frío *nuée* deposits, evidently carbonized by their heat when deposited, of which samples were collected for Radiocarbon dating. The result of this determination: 'more than 35,000 years B.P.' was surprising.

Site I (km. 46). In the right-hand bank, just round the corner beyond Río Frío (going eastwards) a section finally proves beyond doubt the relation of the Papayo lava to the red soils. Some part (not clearly identifiable) of the latter series of deposits is here seen to have been overridden by the still-hot lava, whereby its stratification has been distorted by pressure and thrust and its red-soil substance altered by the heat almost to the state of fired earthenware (Fig. 10).

Site J (km. 47.5). The stratigraphical conclusions already arrived at received further confirmation here. In a section on the left (going east) a series of red soils (exact position in the column unidentified) was seen clearly overlying the deeply weathered Older Lava (Fig. 11).

Site K.1 (km. 48). A section on the right showed a thick pumice-bed (Pumice θ , the *nuée*), overlying a short series of red soils.

Site K.2 (km. 48.5). Beyond Río Frío, this is a deep road-cutting which well displays the lower part of the stratigraphical column compiled at Sites A-H. The upper part, including the 'marker', is greatly eroded, but fortunately this is well represented at Site L, the next, with which direct stratigraphical connections can be established.

The most easily-recognized reference-point is Pumice β , here more than 1 m. thick and seen to rest on a dark brown soil with colloids, corresponding with that at 18.5 m. *b.s.* noticed at Site E. Some 3 m. below this is Pumice α , lying directly on blocks of Older Lava. In comparison with the situation noted at Site E, this part of the section is deficient also.

Above Pumice β there is some disturbance by erosion, followed by redeposition of lenses, up to 5 m. long and 1 m. thick, of medium and coarse gravel, mainly of angular andesites. To the eye of a north-west European, these look,

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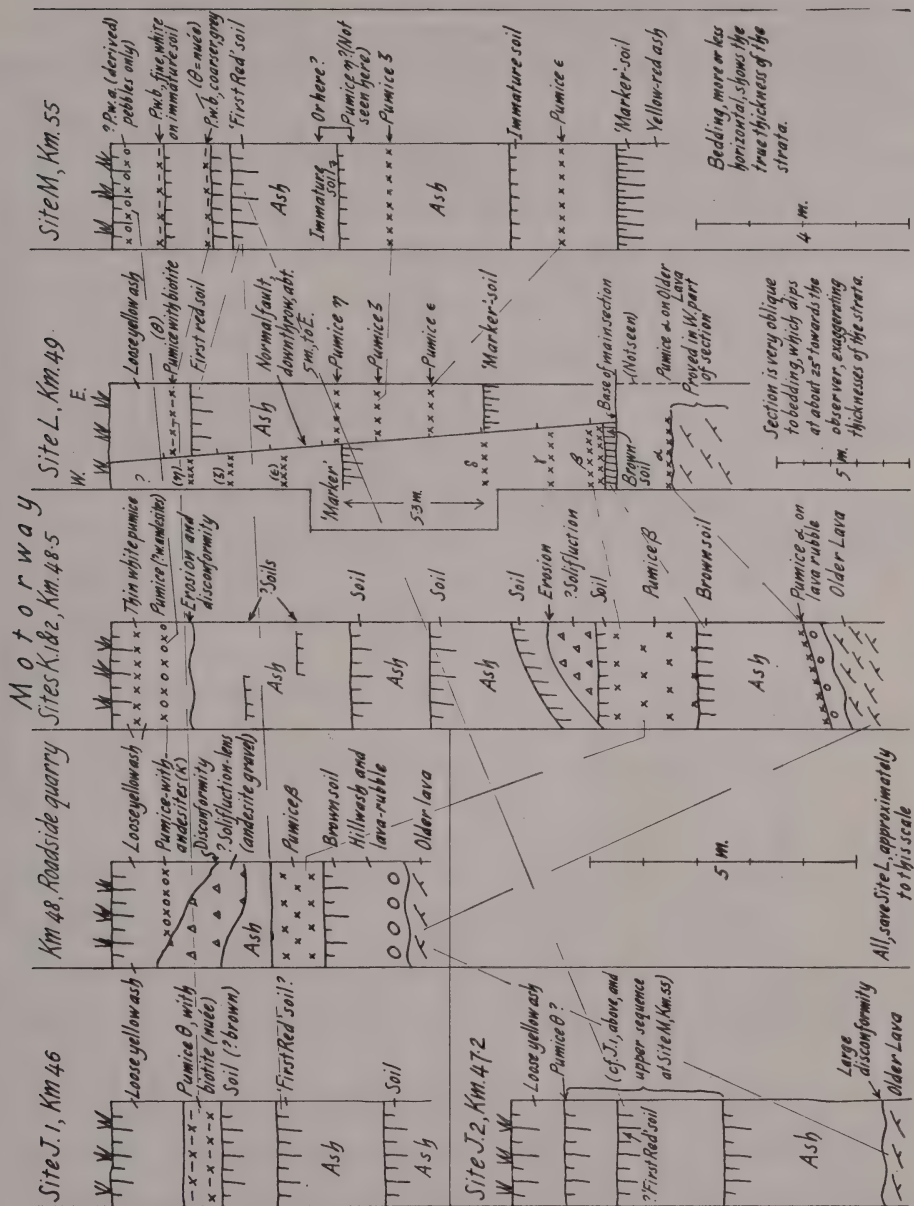


Figure 11

at first, remarkably like solifluction deposits, but this explanation (even at the considerable altitude of Río Frío) was at first discounted by local opinion. It was considered that they must be slope-deposits, or perhaps mudflows, somewhat sorted locally by streams of water. They are, however, completely unstratified.

The section is topped by some slope-washed and redeposited pumice (?Pumice θ , the *nuée*) and there is the usual thick yellow ash over all.

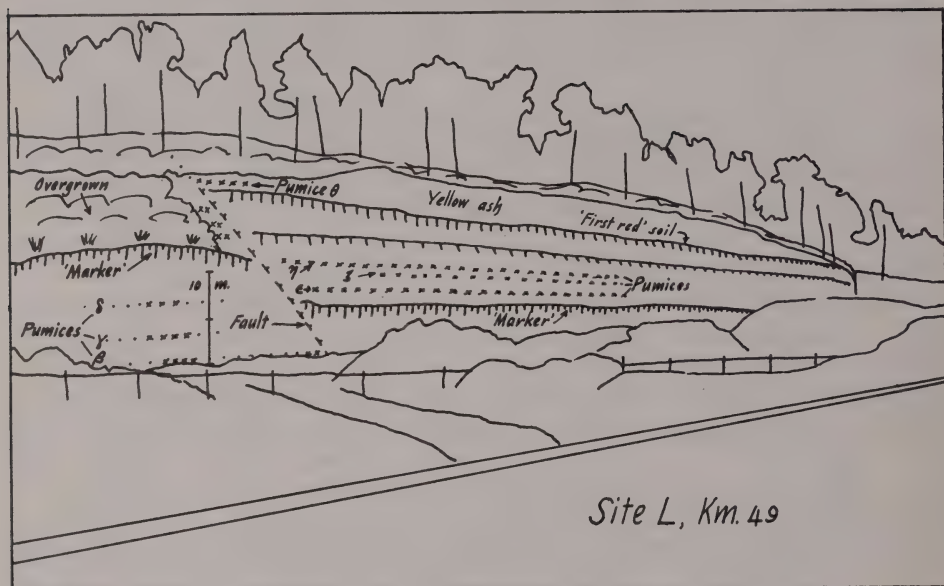


Figure 12

Site L (km. 49) (Fig. 12)

This, though by no means as neatly and well cut as the road-cuttings proper, is by far the largest and completest section in the whole series, repeating as it does, in a height of some 20 m., the entire geological column so far described, from the Older Lava *in situ* to the summit of the 'First Red Soil'. The uppermost part is deficient only in that nothing is apparently represented above this, save a thick bed of the ubiquitous incoherent yellow ash, weathered grey on the flat face.

The site stands some 100 m. back from the road and is an enormous borrow-pit, excavated from the hillside to provide fill for the deep gorge of the Río Frío, which the motorway here crosses on an embankment. No special care was taken by the excavators to leave a clean vertical face, but in fact the cut displays a magnificent section, which, when cleaned where accessible, in short, overlapping columns, shows recognizably most of the stratigraphical detail so far noted.

OUTLINE OF A STRATIGRAPHICAL "BRIDGE"

One difficulty presented itself at the outset, in the form of an unsuspected fault, across which Pumice β , near the base, came suddenly to a full stop laterally and could not be found again. The invaluable 'marker-soil', much higher in the section, provided the answer, being traceable on both sides—a normal fault with a throw of about 5 m., downthrow to the east, involving at least the 'marker' and the three pumices above it. The uppermost part of the section to the west side of the fault was overgrown, dirty and inaccessible, so that it could not be ascertained whether the fault cut the 'first red soil' also. This appeared in its proper position in relation to the rest of the strata on the downthrow side, so that it does seem likely that the faulting was subsequent to its formation.

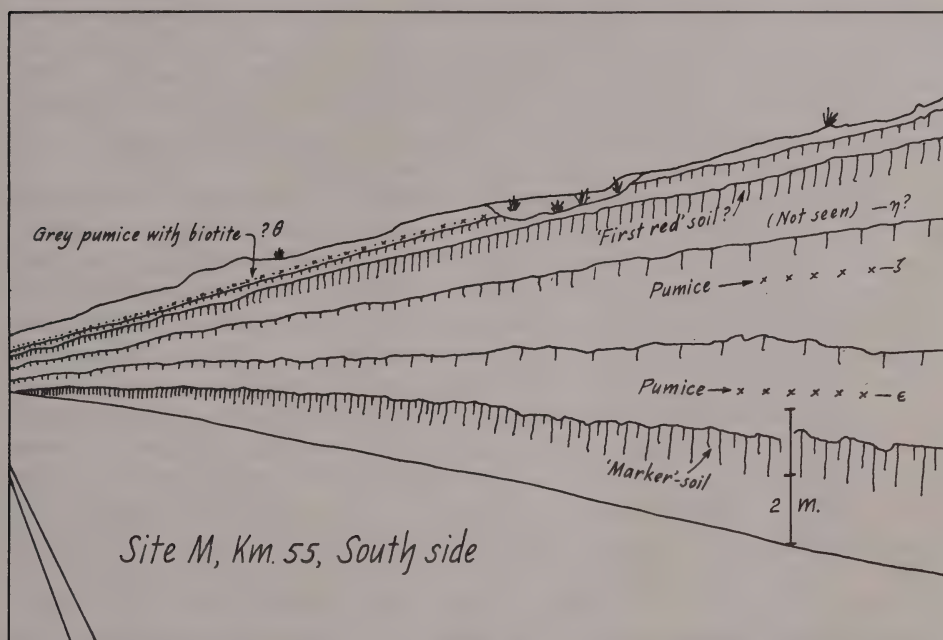


Figure 13

All seven of the lower pumices were identified and, about 1 m. above the base of the overlying yellow ash, on the downthrow side of the fault, a clean, grey pumice, probably representing the *nuée* (θ). The Younger Lava cropped out under the same yellow-ash cover in the next cutting, down the road, but any junction with the red-soil sequence could not be seen, partly owing to the break of the stream-gully in between and partly because it was obscured by the presence of the artificial embankment carrying the roadway.

The great importance of this section was not only that it confirmed the detailed stratigraphy already described, but that it did so well on the Puebla

side of the pass, showing that the same, or a comparable, sequence of volcanic and weathering events might be expected to be represented at least recognizably, even if less completely, further down on the eastward slope of the Sierra.

Site M (km. 55) (Fig. 13)

This site, just beyond the border between the States of Mexico and Puebla, and about half-way along the motorway towards the latter City, exposed a fairly deep cutting with what appeared to be the usual 'marker-soil' to be seen just above road-level. The deep rainwash-erosion shown by this soil chiefly justifies its identification with the 'marker', but it was pointed out that it in fact lacks, here, the characteristic pinkish top by which the 'marker' is recognized elsewhere. This might be due to the difference of exposure, here on a north-facing slope, and so always having had a cooler and moister micro-environment than the same soil, everywhere else seen on south-facing slopes. The reddening of its summit is surely due to dehydration of iron-salts by sun-baking, so that the absence of a red top at Site M may be only a local expression of this difference. In its general stratigraphical relations (e.g. to other soils and to the pumices) it remains perfectly acceptable as the 'marker'.

At least five clearly distinguishable weathering-horizons were seen above the 'marker', itself not included in this number. Of these, the third (counting upwards) was much better developed than the rest and probably corresponds with what we have elsewhere called the 'First Red Soil'. The two uppermost are not, so far, represented in any other section, but, as at Site L, there generally appears to be a sharp break in sedimentation above the 'first red soil' and this additional sequence may correspond with that gap. In particular, there is a thin red soil, its surface only 50 cm. above that of the 'first red soil', not seen hitherto.

The two lower members of the three pumices above the 'marker' (ϵ , ζ) were duly identified, though not as clearly and typically developed as at Site L, only 6 km. back. A new discovery, however, was a fine-sandy grey pumice lying directly on the surface of the small soil which immediately follows the 'first red soil'. Though, stratigraphically, it agrees in position with the *nuée ardente* (θ), on closer examination it is seen to contain numerous tiny crystals of a bright golden-coloured mica, perhaps a sericitized biotite, not present in any of the lower pumices and only very sparingly represented in the *nuée* deposit.

About 1 m. above this is an even slighter weathering-soil, and on it a very fine white pumice, also with biotite, up to 20 cm. thick. The uppermost part of the section is much disturbed by the traffic of the motorway-builders. There appears, originally, to have been a brown or grey modern soil, containing or covering a deposit with numerous coarse pumice-lapilli and small andesite pebbles. In view of what we already know, this looks very like the expected situation of a coarse pumice with andesites from Popo, but the roundness of the rock-fragments shows that, if so, it was not here *in situ*, but slope-washed.

OUTLINE OF A STRATIGRAPHICAL "BRIDGE"

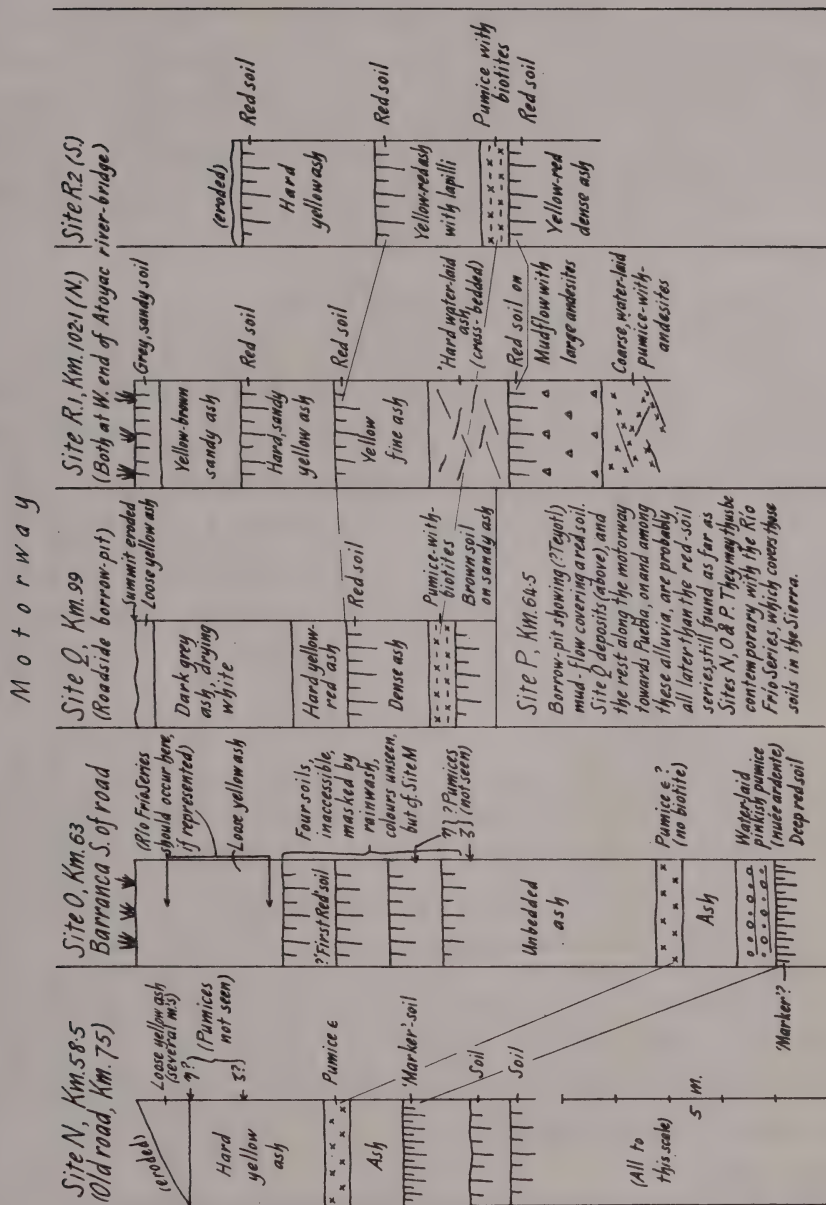


Figure 14

At km. 58 on the motorway there is a very deep stream-gully, cut by a small affluent of the Atoyac River, which is bridged both by the old Puebla road—Puente el Emperador—and the new motorway, in which the old name has been adopted. The walls of this gorge exposed deep, uniformly grey-coloured sections in volcanics, showing here and there, by their columnar erosion, some apparent buried soils. There were also some intercalated fluvial sediments. Disappointingly, however, nothing could be seen comparable with the more highly-coloured soils described above. The sections are inaccessible, but might repay the trouble of close inspection and cleaning if they could be reached by ladders or ropes.

Site N. (Old road, km. 75; Motorway, km. 58.5) (Fig. 14)

It was reassuring, therefore, to find a section near by, on the old road, at a point some 500 m. past the bridges, where the two roads run closely side by side and where red soils were still to be seen. This site, facing the south, showed a deep red soil with columnar weathering and pinkish top, unmistakably our 'marker', and, about 1 m. above it, bedded in greyish-yellow ash, a fresh loose pumice 45 cm. thick (Pumice ϵ) and (as it should be!) without biotite. The upper part of the section, above the pumice, was formed by dense, somewhat weathered-looking fine ash, forming 'steps', and so more like the 'hard tops', presently to be described, than the usual sequence of deposits above the 'marker'. No trace was found in this of the other (ζ , η) pumices of the upper group. The first explosion of the trio was evidently a very big one (*cf.* Site G, Pumice ϵ) and its products may have reached this distant point while those of the others did not.

Site O, (Motorway, km. 63)

A natural exposure in a 15 m. deep stream-gully on the right (south) side of the motorway, was mostly inaccessible for cleaning and accurate observation. It showed (measurements estimated by eye), from the surface downwards: Yellow ash (3 m.); four weathering-surfaces 1 m. apart, of which the colour was unseen, but possibly red, behind the obscuring surface wash; unbedded ash (4 m.); clean, white, loose, fine-grained pumice (50 cm.); ash (1 m.); a thick pinkish pale pumice (apparently of a *nuée ardente*—not *the nuée*!), redeposited by water; hard yellow ash with a surface somewhat weathered; tough red-brown soil with eroded surface, of which the base was not seen.

The *in situ* pumice contained no biotite. Its thickness of 50 cm. only 4.5 km. from Site N, and its stratigraphical position, capping 1 m. of unweathered ash, suggest that, once more, this is Pumice ϵ .

Site P (km. 64.5)

Here, we are already on the lower slopes of the foothills of the Sierra, in the zone of mudflows from the big volcanoes, which tend to bury all older

OUTLINE OF A STRATIGRAPHICAL "BRIDGE"

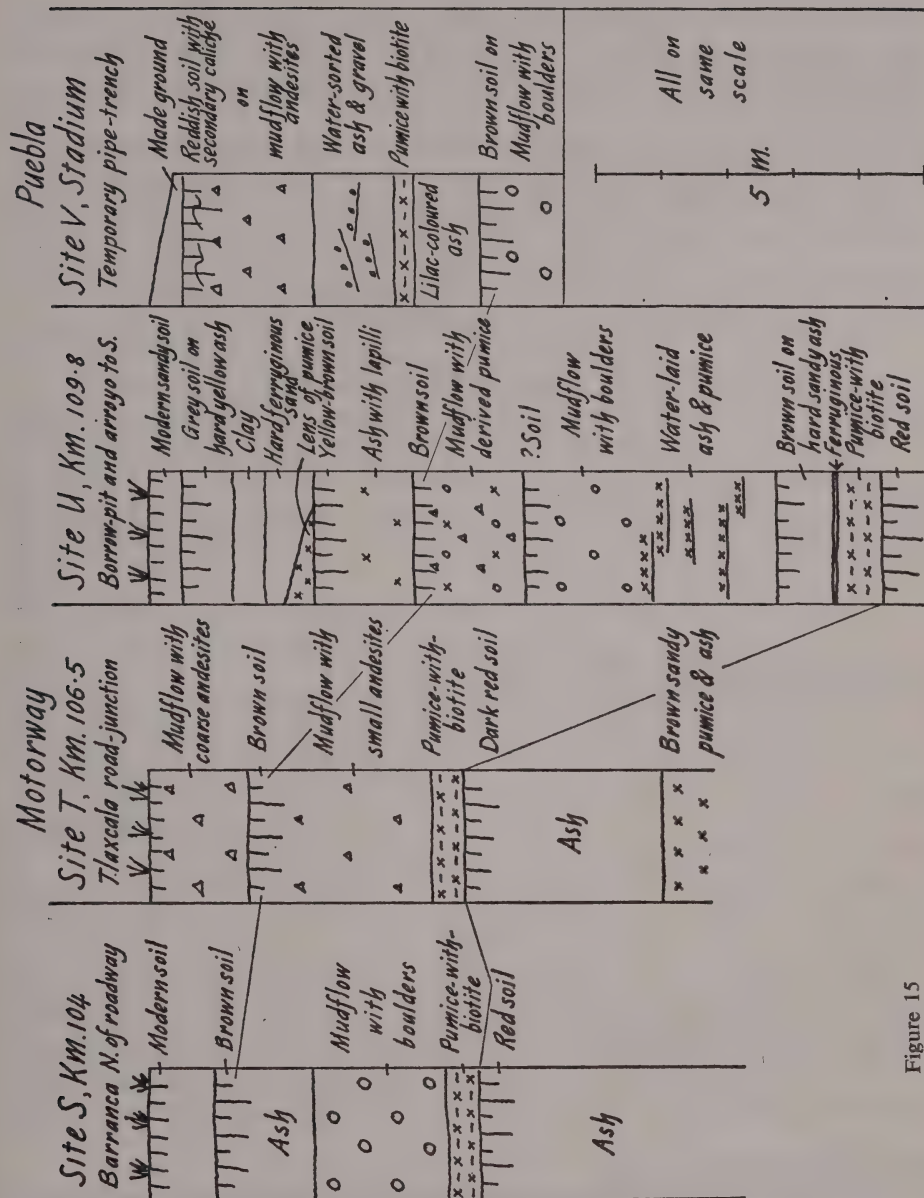


Figure 15

deposits. A shallow borrow-pit at the roadside, exposing mainly a mudflow with unsorted large stones (perhaps from Teyotl), just uncovers red-brown soils at the base. There are few exposures at all, and no deep sections, but it seems likely, from such occasional glimpses, that the red-soil sequence, or its local correlatives, does persist at some depth beneath these widespread blankets of alluvial sediments.

At km. 76.7, there is a football-pitch on the floor of an abandoned brick-pit, to the north of the motorway. Some 3 m. of section are exposed in the somewhat eroded walls of this pit. From the surface, down, the deposits are: (1) Mudflow, with many less than fist-sized well rounded pebbles (2 m.); (2)

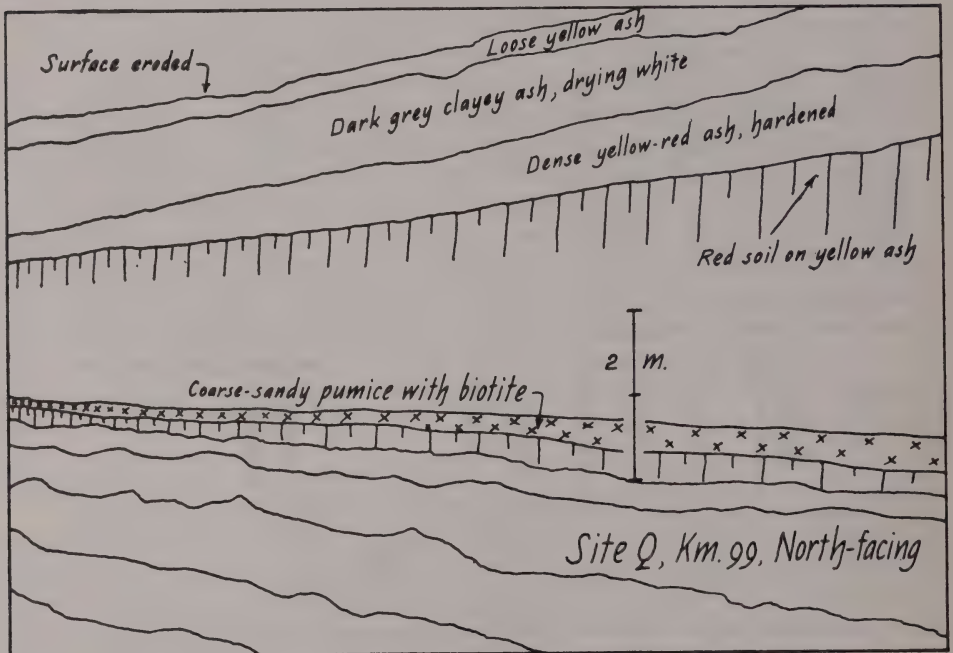


Figure 16

water-laid, well sorted loose pebble-gravel, cross-bedded, in a finer sandy matrix (1 m.); (3) just showing in the deepest parts, an eroded surface of red weathered material—probably one of our red soils—of which the base was not seen. This usefully renews the hint, referred to above, under Site P, that these older deposits do continue beneath the cover of the later mudflows and alluvia.

Site Q (km. 99) (Figs. 15, 16)

A fairly deep borrow-pit, in a field on the south side of the motorway, shows the following section, from the surface: Yellow ash (0.2 m.); dark grey

(?humic) weathered ash-soil, drying almost white (2.0 m.); dense yellow ash (1 m.); a red soil (1.5 m.); fresh pumice, of medium-sand grade, with plentiful 'golden' biotite crystals (all coarser than either of the examples seen at Site M) (60 cm.); brown soil (base not seen).

In view of the long interval (44 km.) between Sites M and Q, any correlations between the biotite-bearing pumices at the two sites would be hazardous. The markedly increased grain-size of the biotites at the sites near Puebla suggests that, here, we have a volcanic product emanating, not from any vent in the Sierra Nevada, but from one somewhere to the east.

Site R (km. 102.1, Atoyac River Bridge) (Fig. 14)

Two sections are exposed, respectively on the north side of the motorway, in the road-cutting and in the adjoining old river-cliff of the Atoyac (R.1) and one on the south side, in the road-cutting only (R.2).

R.1 has been considerably spoiled since it was first examined, by earth-moving operations in connection with the construction of the nearby new Volkswagen plant. Over 10 m. of deposits, conforming to the slope of the valley-side, were measured: (1) Grey-brown sandy modern soil (40 cm.); (2) yellow-brown sandy bed with interstitial colloids (1.5 m.); (3) a fresher, harder deposit of fine ash, denser below but with a reddish top, indicating some sub-aerial weathering (1.8 m.). (4) is very like (3), again with a red top (2 m.). The underlying bed (5) is even harder and more resistant to modern denudation, yellow, mainly fine-grained, but with coarser, water-laid lenses, probably somewhat disturbed by slope-washing. There is no sign of weathering at its summit. It lies on a well-developed red soil formed on (6), a material haphazardly stony towards its base but finer above—a mudflow. The soil erodes readily, so is exposed under a wide overhang of (5). The base of the mudflow is indistinct and merges into a thick (1 m.) water-laid pumice (without biotites), of which the base was not seen.

Site R.2, immediately opposite, shows stratification differing slightly from the above and rather like that at Site Q. The section is somewhat eroded at the summit and the modern soil is missing. Beds (2), here 1.5 m., and (4), 2.3 m. as compared with R.1, are represented, but the mudflow (5) is missing and is here replaced by a clean grey, medium- to coarse-sandy pumice with large hexagonal biotites. This is clearly an air-fall, perhaps only locally disturbed by the mudflow, only a few metres away. The pumice lies on a yellow-red soil formed on dense ash, of which the base was not seen.

Site S (km. 104) (Fig. 15)

The section is on the north side of the motorway, in a stream-gully running more or less parallel with it for some distance. Beneath 5 m. of ash, including one buried soil as well as the modern weathering at the surface, and another

2 m. of mudflow deposit with boulders, comes, once more, 50 cm. of fresh-looking pumice with biotites. This rests directly on the level, uneroded, surface of a deep (2 m.) red soil.

The contemporary surface-material on which the pumice rests—a soil of some kind in every case—varies considerably from site to site, but this is probably the same pumice that we saw at Sites Q and R, previously, and which reappears at other sites further on.

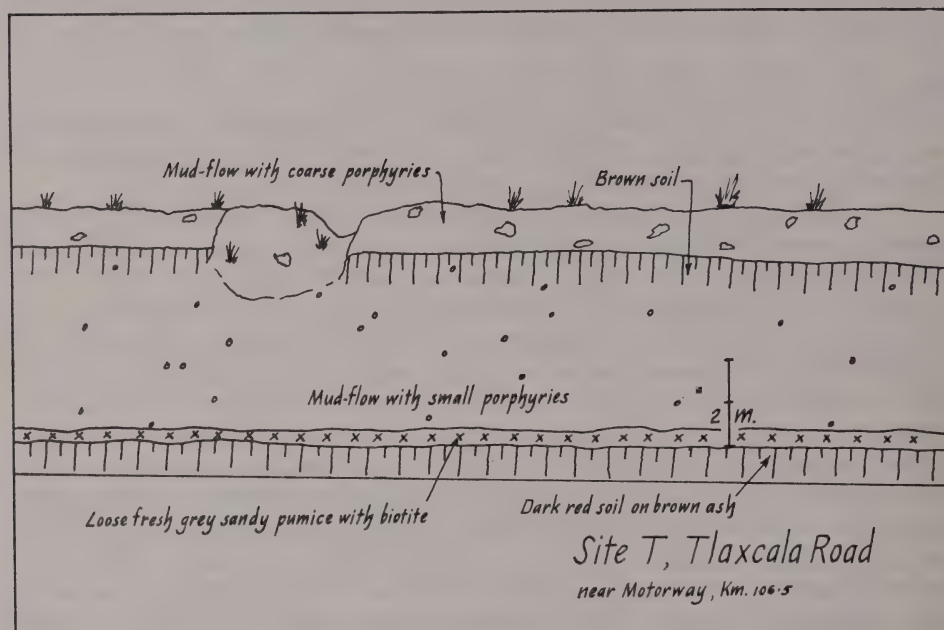


Figure 17

Site T (km. 105.5) (Figs. 15, 17)

The section is displayed on both sides of a road-cutting, on the branch-road to Tlaxcala, about 100 m. from the motorway proper.

It is capped by (1) a mudflow, 1.6 m. thick, with porphyritic andesite boulders, overriding another (2) of similar origin but with much smaller stones (3 m.), having a brown soil at its summit. Below this is (3), 50 cm. of loose, clean, coarse-sandy pumice-with-biotites, resting on the brown-weathered surface of a bed (4) of dense ash, of which the base could not be seen here, but was proved in a gully a few tens of metres further up the road to be 2.7 m. thick and to rest on (5), a coarse brown sandy pumice mixed with ash.

Site U (km. 109·8) (Fig. 15)

Again the section (partly in a borrow-pit—U.1—and partly, to a greater depth, in a natural stream-gully—U.2—was a short distance from the motorway, to the south-west.

U.1 displayed about 10 m. of deposits, mostly mudflow with large boulders, lenses of water-sorted materials and, near the foot, water-laid pumice and ash in thin bands. A few rather immature soils in the section suggested that all this had not taken very long to accumulate. The water-sorted pumice-bands were repeated near the top of U.2, near by, and, though very variable laterally, afforded a probably reliable stratigraphical link over the few metres between the sections.

In the gully-section, U.2, all the deposits were more or less water-sorted, adding another 3·5 m. of depth below the floor of the borrow-pit. The chief feature of interest was a somewhat water-sorted bed of pumice, hardened but clean, and so not far from its original place of deposition. It rested, in the modern stream-bank, on the eroded surface of a tough, dense red bed, having the same colour and general appearance as some of the red soils already noted. This pumice contains the 'golden' biotite and is probably the original source of the mineral here, which was first noticed at higher points in the section, but was there clearly derived and perhaps long subsequent in deposition to the first fall of the pumice.

Site V (Fig. 15)

This site is near the motorway, but a few hundred metres to the south of it, close to a main approach-road to the City of Puebla, opposite the Cinco de Mayo battle Centenary Monument. When seen, an enormous circular excavation was in progress for the construction of a sunk sports-stadium, with all the attendant works, such as drainage-trenches. In one of these, near the road, slightly to the south of the stadium-excavation, a pumice-with-biotites, perhaps somewhat water-sorted, was seen at a depth of 3·75 m. from the surface, below a buried red soil on mudflow material at —1·0 m. The main excavation repeated this sequence and, further, showed, below the pumice, a dark brown (when moist) soil with plentiful colloids, being the weathered surface of another thick mudflow, containing often very large (up to 1·0 m. in diameter) andesite boulders. This extended to at least 10 m. below surface and its base was not exposed.

Site W (Fig. 18)

The road which leaves the motorway near Site V turns due south and climbs across the flank of a Quaternary ash-cone (Cerro de Loreto) on its way towards the centre of the City, by a main street (2 Oriente) on the far side of the Cerro. Just where it begins to rise above the level plain, on the north flank of the Cerro, there is an area of gully-erosion to the west of it, in which a succes-

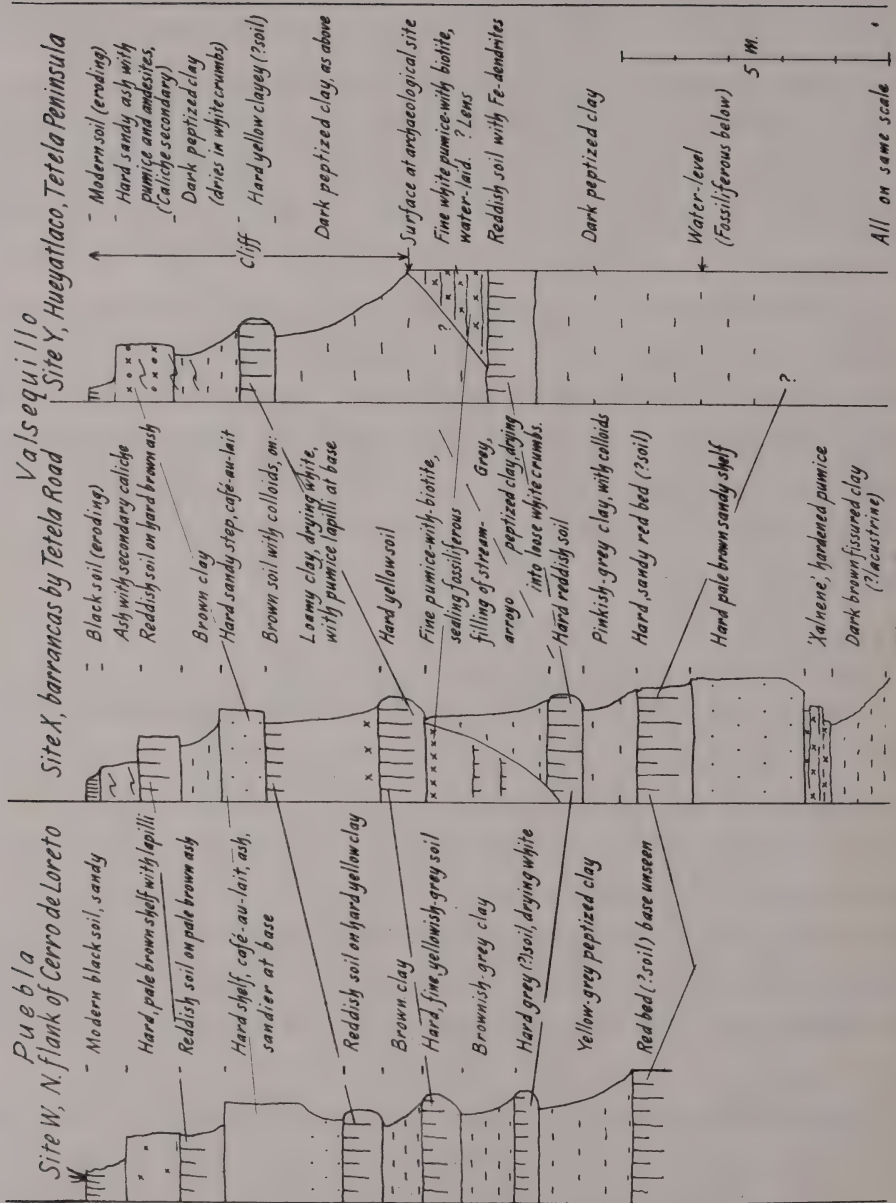


Figure 18

sion of more than 10 m. of deposits is exposed. These are conformable to the hill-side and appear to dip down beneath the more or less horizontal mudflow deposits described at Site V. In that case, they would be antecedent to the latter and comparable, at least as to their stratigraphical position, if not age, with the red-soil deposits in the motorway cuttings. These, as we have seen, are similarly almost completely concealed, on this side of the Sierra, by the alluvia, from about km. 58.5 (Site N) onwards. Only where, as here, slightly higher ground brings them above the alluvial plain, or in comparatively scarce deep stream gullies, is their uppermost part otherwise exposed.

Since a pumice-with-biotites is represented in the presumably overlying Site V deposits, this whole succession should be somewhat older than that, i.e. comparable in age with some part of the motorway sections below the 'first red soil' at least. There is, of course, no proof that it is not very much older than this, but its situation, on, and conformable to, the slope of a Quaternary volcano, is against any much greater geological age.

The succession begins (from below) with a dense, sandy red bed (1) of which the base was not seen. This has a subaerially-weathered appearance, owing to its state of complete oxidation and the presence of ferruginous precipitates in cracks and conducting channels. On this lies (2), a dark yellowish peptized clay, unstratified and apparently homogeneous. On drying, this shrinks and cracks, breaking down into small crumbs, which appear almost completely white when fully dry. These form a loose talus, sloping down from the section at their angle of rest. (3) is a more compact layer, 30 cm. thick, resistant to breakdown on drying and so standing out as a hard shelf. On this lies another clay-crumbs talus (4), just over 1 m. high, the fresh material being rather browner in colour than the bed below. This is followed by a second hard bed (5), 45 cm. thick, grey with yellow interstitial colloids when freshly exposed. On it lies yet another clay-bed (6) 50 cm. thick, drying, as before, into crumbs, with a hard top (7), 25 cm. thick, in this case distinctly reddened at its summit—a soil.

Bed (8) forms another talus, but is sandy rather than clayey, with undecomposed mineral crystals recognizable under a hand-lens (75 cm.). On it lies, with a slight overhang, (9), a dense hard ash, 1.25 m. thick, of a uniform yellow-buff colour, forming a thick resistant shelf with a vertical edge. This bed, in most places, forms the rim of the gullies, the overlying beds being less resistant and having been eroded back from the edges of the stream-cuts. They are best displayed in a fairly fresh artificial road-cut, about 2 m. high, just uphill from the gullies, of which the main watercourse passes under the road at this point in a culvert. (10) is a fairly hard, but less coherent, sandy bed than (9), about 1 m. thick, with a distinctly red top. On this lies (11), 30 cm. of sandy yellow ash containing numerous pumice lapilli. The modern, grey-black sandy soil (12) is as much as 1 m. thick at maximum, but is widely eroded and generally survives to a thickness of only a few centimetres. No pumices, save the scattered lapilli in bed (11), were anywhere noticed.

Except for the three or four thickish (c. 1 m.) harder sandy beds at the summit, which are paralleled by those at Site R in particular, the rest of the section differs considerably from anything so far seen and is hard to interpret. The former are plainly fairly fresh volcanic ash-falls, in some cases weathered above, denoting a pause in deposition. They can be matched as far back and as high on the slope of the Sierra as Site N, near Puente el Emperador (c. 2,475 m.).

The clays, on the other hand, are something new. They look, judging by their content of colloids, to have been intensely chemically weathered throughout, as do the corresponding harder beds intervening. Though they exhibit no horizons, they were at first sight interpreted as soils *in situ*. It is difficult, indeed, not to see them as soil-materials at least, developed ultimately from finer pyroclastic sediments. In this volcanic environment no other likely parent material presents itself. This ash was perhaps washed from the land-surface on which it was formed and redeposited in water, though the very even thicknesses of the several deposits and their lack of internal stratification make even this process hard to visualize.

The harder beds, (3), (5) and (7), are no more readily explained. In the case of (7), there is clear oxidation of its summit, and this must, surely, be due to subaerial weathering after its deposition and before the fall of the overlying material. Neither of the others is unmistakably a subaerial surface, but their very tenacity, in comparison with the clays, calls for some explanation. In no case is it due to impregnation with calcium carbonate, as one might, at first sight, have supposed. It may be due either to a sandier texture, preventing the destructive shrinkage and cracking, so characteristic of the finer clays as they dry out, or to impregnation with some other cementing material, such as ferruginous precipitates. These, too, would require some subaerial process for their formation.

The regular alternation of clays and hard beds suggests that they are associated together in pairs, the harder being the result of some process of alteration of original clay, due to some environmental change, several times repeated. Laboratory investigation of samples may be expected to throw some light on their present differences in physical and chemical properties and structures. This, in turn, may lead to some conclusions as to their mode of formation.

Site X (Fig. 18)

Ten kilometres from Site W, south-east of the City of Puebla, is the present-day artificial reservoir of Valsequillo. A westward-sloping hillside on its northern shore, flanking on the left the road going down to San Baltazar Tetela, is extensively gullied and exposes a long series of sedimentary deposits. As at Cerro de Loreto, these mainly conform exactly to the slope of the hill, which, in mid-slope, is of the order of 5° with the horizontal.

In the cliff on the lake-shore the deeper deposits are exposed, just above seasonal water-level (fairly high still, though already falling, in mid-February).

The pre-Pleistocene 'solid' hereabouts is a breccia of Cretaceous limestone of Tertiary age. Bed (1) of our section, of which the base is well below water-level in the lake-cliff, was seen to lie directly on the breccia in a small gully a little uphill from our main site.

Bed (1) is a dark brown (when moist), vertically-fissured colloidal clay, apparently of lacustrine origin, though without internal stratification. It dries out to a pale grey colour and shrinks into small crumbs. It is apparently unfossiliferous. (2) is a well-bedded, hardened, coarse-sandy pumice, 1.5 m. in thickness at the lakeside, but wedging out uphill within a few hundred metres, so that it is no more than a few centimetres thick in the small gully referred to above. The pumice is said to have been deposited in water, but this is not necessarily the case, for one has seen many undoubted air-fall pumices equally minutely sorted and banded. It is known to be of quite local origin, emanating from the nearby Cerro Colorado. Because it splits readily along bedding-planes into thin parallel-sided slabs, the pumice is used locally as a building-stone, called '*xalnene*', and forms a readily-recognizable reference-horizon.

Bed (3) is a massive, hard, sandy buff-coloured ash or tuff, without obvious colloids. It weathers into a step 1.7 m. high, with a vertical edge, overhanging the less resistant *xalnene*. A strikingly red bed (4), up to 1 m. thick, with more clay and colloids than (3) and ferruginous precipitates in cracks, is perhaps only the weathered upper part of (3). It is described separately until this can be shown to be the case. The middle part of (4) is tough and resistant to modern erosion, so that it in many places forms the floor of the lower parts of the gullies and is one of the putative red soils noted in 1960 for further study. It becomes more clayey, though still red, in its upper part.

On this lies 1 m. of dark pinkish-grey (when moist) peptized clay, like all the others described drying into almost white crumbs and forming a loose talus lying at a fairly low angle. It passes upwards, without any very distinct boundary, into (6), a less friable reddish layer, 75 cm. thick, which stands out in relief in a weathered section as a rounded 'step'. This seems to be a chemically-altered portion of the same deposit—a soil, in fact—but is for the time being, as at Site W, treated as a distinct entity. (7) is a dark neutral-grey (i.e. not at all reddish) fissured clay, 2 m. in thickness, completely peptized, homogeneous and unstratified, as far as can be discerned. As before, it dries out nearly white, forming a mass of small crumbs.

At one place there is an outlier of deposits, separated from the main massif of the gully-wall by the road-cutting. This lies to the west of the road. The cutting exposes in the section of this outlier a shallow stream-channel, about 30 m. wide (in the plane of the section, not necessarily truly transverse) and 2.7 m. deep at its deepest part. This cuts into and through Bed (7) and down into

(6). The channel was then gradually filled again level with the top of (7), its section showing at least two slight pauses, during which weathering of the accumulating filling took place. The channel-filling—and only the filling, it seems—contains mammalian bones. Systematic excavations for these were carried out in January 1966 by a team of German palaeontologists from Kiel, Drs. Günther and Walther. The site is, therefore, conveniently identified here as ‘the Germans’ site.

The very top of the channel-filling consists largely of pumice, which is micaceous, containing the same sort of ‘golden’ biotite crystals as those noticed elsewhere. A very fine pumice-with-biotite was proved at the summit of another channel-remnant a little further down the road, for this is not the only fossil *arroyo* hereabouts. Several others were investigated near by by the German expedition and have yielded fossils. All are considered, on palaeontological grounds to be approximately contemporary with the Valsequillo Gravels, similarly fossiliferous, which are exposed in the gorge of the Alceseca River and elsewhere.

The great interest, for this study, of the Valsequillo Gravel horizon is that, near Site X, at Hueyatlatco (Site Y—see below), a probably corresponding deposit yielded to Miss Cynthia Irwin human artifacts along with the bones of extinct animals. Though this may be only a stream-deposit, and the material not *in situ* on a land-surface of actual human occupation, this discovery in any case suggests the approximate contemporaneity of early man with the extinct animals. Further excavations are in progress, or planned, which may succeed in proving the association to the satisfaction of all.

The fortunate circumstance of the occurrence of the mica-bearing pumice in close relationship with the fossiliferous deposits may enable us to link Hueyatlatco with the chronology of the motorway sections.

The grey clay (7), with the cut-and-filled stream-channel (8), is topped by a harder bed (9), 60 cm. thick, which weathers out as a rounded step. As at Site W, when seen in a fresh, clean section, the harder bed shows no discontinuity with the underlying clay, but only a slightly darker, yellowish colour. Work on the samples may elucidate their nature and origin. Their macroscopic appearance does not lead to any very firm conclusions.

The next bed (10) is a deposit topped by a manifest weathering-soil. It forms a talus 1 m. in height, like (7), but is much less clayey. It contains some coarse-sandy material below (? pumice), becoming finer above, with much colloidal matter of a yellow colour, as can be seen under a hand-lens.

The surface of (10) is immediately covered by a hard, yellowish-brown fine-grained material, 1 m. in thickness, weathering to a sharp-edged square shelf, slightly overhanging the talus beneath it. This is, seemingly, entirely homogeneous and looks like a consolidated single-incident airfall of volcanic ash.

Above it comes a brown, more clayey, layer (12), 50 cm. thick, forming crumbs and falling away on drying. It is followed by another hard bed, yellowish-buff below, with a distinctly reddened top, 90 cm. thick in all. The material of the red top breaks down into sand on slight pressure between thumb and finger and erodes under rain-washing in the now classic 'columnar' fashion of the motorway soils. There can be little doubt that it is of similar nature and origin.

Covering all is a 1.1 m. thick grey-black modern soil, lying on a paler, ashy, subsoil with much caliche (secondary calcium carbonate) infiltrated into cracks. Where they lie bare under modern erosion, deeper beds also contain caliche in fissures, but this is clearly due to modern, or at least recent, infiltration from overlying soil. The caliche is nowhere found in any of the deposits which has been protected by a considerable overburden from recent infiltration.

It must be emphasized that this section, though recognized with only minor variations in a number of closely-adjacent gullies, cannot be taken to apply necessarily to any larger area. It has some clear resemblances throughout with that at Site W and the two hard 'café-au-lait' beds near its summit look very like those seen also at Site R, if without any proof as yet of identity or contemporaneity.

Site Y, Hueyatenco, on the Tetela Peninsula

This site, first excavated by Miss Cynthia Irwin in 1964, is on the lake-shore of the Valsequillo reservoir. When first seen, in January 1966, the floor of the excavation was under three metres of water, the previous summer having been unusually wet and the reservoir-level, therefore, near its maximum. The fossiliferous sediments excavated seem to have been deposits of a stream-gully and to expose these again the Dept. of Prehistory of the Instituto Nacional de Antropología e Historia in the spring of 1966 cut two deep trenches transversely to its presumed course, a few metres to landward of the flooded excavation of 1964. One of these reached the fossiliferous layers during my stay, at, and just below, the current seasonal water-level. This was at about 6.5 m. below ground-surface at the site, which was on a shelf backed by a low cliff, which added another 5.5 m. to the total geological column observed.

The section, from below, upwards, was as follows:— (1) Dark grey peptized water-laid clays (4 m.), drying out almost white and crumbling. They were scarcely differentiated in depth, to the eye, but contained mammalian fossils towards the bottom of the trench, near water-level.

Above (1) there was about 1 m. of reddish-brown humic (?) soil (2), with numerous root-channels, apparently formed under vegetation on a subaerial surface of the clays. Its redness is due to oxidized ferruginous precipitates infiltrated into cracks. This horizon can be traced back into the cliff-section, not far from the site of the archaeological trench, where, like other supposed sub-

aerial soils developed on similar clays (Site X, Beds (6) and (9), for instance) it weathers out as a rounded 'step' on the section, between a talus above and another below, consisting of practically white clay-crumbs.

At the site itself, this reddish-brown soil is immediately followed by 1.25 m. of strikingly white, horizontally-bedded fine pumice of a floury consistency, (3), the somewhat eroded top of which forms the present ground-surface there. This appears to have been deposited in water, for its fine stratification shows some small-scale cross-bedding. It contains throughout numerous very fine 'golden' biotite crystals. Northwards, the outcrop of this bed forms a blunt promontory at the corner between the lake-shore and the small bay in which Miss Irwin's trenches were situated, at a lower level. The stratification can, thus, be seen in two planes at right angles and appears, to an uninstrumented eye, to be perfectly horizontal. The plane of the old land-surface on which it lies, however, dips lakewards (to the N.), as do all the other strata now to be described, at about 5° with the horizontal. Small though this difference is, it is interpreted as a real angular unconformity, but, since the soil-surface beneath is plainly not eroded, the time-interval which it denotes can hardly be very long.

Towards the cliff, the closely-bedded white pumice in the section of the first trench ends where it has been cut through by a small modern erosion-gully, running from the cliff-top down to the shore and filled with recent top-soil. The brown soil beneath the pumice is still in part intact and can be traced laterally, southwards, into the cliff in the bay, where it is directly overlain, quite conformably, by another 1 m. of undifferentiated, dark peptized clay (4), drying and weathering to the characteristic crumbly talus.

This is topped by a harder layer (5), 1 m. thick, still containing colloids and plentiful ferruginous precipitates, which weathers into irregular prominent knobs rather than a distinct 'step'. It appears to be another soil. Some secondary caliche here penetrates it from above.

Another talus-forming peptized clay (6), 1.25 m. thick, covers this and is capped by 75 cm. of hard, yellow-brown ash (7), full of pumice and andesite lapilli, some colloids and infiltrated secondary calcium carbonate. The modern soil (8), 50 cm. thick, is eroded back from this hard cap, which forms the almost vertical edge of the cliff-summit. All these deposits, save the pumice, slope gently northwards with the valley-side.

An important problem for this study, is the elucidation of the stratigraphical relationship of the micaceous fine white pumice to the rest of the section. The deposit is quite restricted in area, extending laterally, eastwards along the lake-shore to a distance of less than 50 m., where it thins out and is cut off by the next shallow embayment to the east. Its extent cliffwards is unknown, save that it forms no part of the cliff-section in the bay south and west of the archaeological site. A wider survey in the immediate neighbourhood showed nothing else remotely like it. Whatever its relation to the main section, therefore, it seems, as far as can be seen at present, to occupy only a small area.

Now, an air-fall of such pumice would presumably mantle the whole countryside. On land, however, under wind, rain and the force of gravity, it would easily be blown and washed about, become mixed with other sediments in streams and so lose its identity. The fact that this patch of it was preserved in a practically pure state seems to be due to its having been deposited in water. The same, of course, applies to the fine biotite-bearing pumices at Site X, just across the water from Hueyatenco. They figure recognizably only in the stream-channel fillings, *and nowhere else*, and, in that situation, lie essentially horizontal, whatever the slope of the beds into which the channels are cut.

It looks, therefore, as if the white micaceous deposits in the Hueyatenco trenches are also the filling of a shallow stream or bay of a lake, formed under still, or only very gently flowing water, as their fineness testifies. Such conditions would prevail if a lake controlling the base-level of nearby streams were rising and ponding back their flow, so that such fine sediments could accumulate in their former channels, as at Site X, and, in the case of Site Y, over an old sloping land-surface on its former bank. Towards the valley-side the upward slope of this bank would shortly bring it above the maximum water-level, where no white pumice deposit could long preserve its identity.

Site Z (Tlapacoya), Boundary-Trenches I and II (Fig. 5)

The Cerro de Tlapacoya is the remnant of a Tertiary lava-volcano, which formed an island when Chalco was still a lake.

The site is within a few hundred metres of the motorway, at the foot of a steep slope on the eastern side of the Cerro, facing the Sierra Nevada. There was formerly a considerable talus of weathering-rubble and slope-wash here, more or less interbedded with airborne volcanic materials and the deposits of the lake itself.

When the motorway was built (1960-64), this talus was cut into by mechanical excavators, all along the foot of the Cerro, to provide material for the low embankment on which the roadway is carried. The archaeological site, on an old high beach, 2-3 m. above the lake-bed, is now perched on the edge of an almost vertical artificial cliff.

Two trenches were run out, at right-angles to this cliff, cutting 2 m. deep into the lake-floor and exposing a series of organic muds, interspersed with beds of pumice and volcanic ashes, representing a long succession of environmental events, apparently largely subsequent to the human occupation. The description of these sections and correlation of the archaeological levels with the lacustrine succession is a matter for the excavators of the site and is not considered here.

By a fortunate chance, two more trenches, a few hundred metres to the north of the archaeological site and nearer to the village of Tlapacoya, exposed similar sections, which are here recorded, for eventual comparison with the former. They were opened at the instance of a local landowner to delimit her

property and exclude wandering stock. It was only necessary for the walls of these to be cleaned down for a long and detailed geological succession to be seen. These trenches are designated 'Boundary Trenches I and II'.

It is immediately striking that the entire stratification here, as in the Goodliffes' trenches, tilts lakewards at a very constant angle of about 10° . The mechanism of this tilt is not yet fully explained, but has the fortunate result of greatly increasing the height of the geological column exposed: in the case of B.T. I, from 2 m. to 8.3 m.

The important point about the tilt, here, is that it must be a fairly recent development, for it involves even the latest layers, which contain the evidences of pottery-using inhabitants, at the extreme eastern end of B.T. I, and so must be subsequent to their deposition.

The tilt seems to be due to considerable shrinkage and settlement of the bentonitic lake-clays, following recent drainage of the Chalco Basin. The thickness of these, and so the amount of shrinkage, increases as we leave the foot of the Cerro. The more shoreward sediments are, further, supported by the buried slopes of the lava-volcano over which they lie and which may be supposed to have stood firmly throughout the period of our interest, while the distal parts of the strata have sunk, giving the 10° easterly dip which we observe. Some erosion, whether natural or human (largely, perhaps, the work of the motorway builders with their scrapers) must have ensued since the tilting, for, at least in all four trenches seen, the shoreward ends of the uptilted strata are truncated by the present surface, where they might have been expected to interdigitate with slope-deposits of the Cerro.

It is fairly certain that the beds concerned were horizontal when formed, for the bulk of them consists of exceedingly fine clays, black in colour when moist owing to a high content of amorphous organic matter. Even if flocculated by electrolytes (as they may well have been on deposition, for when drying out the present surface shows saline efflorescences) such masses of humic flocks take some time to consolidate and lose their interstitial water, have a density very little more than 1.0 and would readily flow down slopes of 1° - 2° , let alone 10° . The beds are on the whole extremely even in thickness and such flow may, therefore, safely be discounted.

For the purposes of this study, the great importance of the sections in the Boundary Trenches is that they include distinct layers of volcanic sediments, at least some of which are clearly *in situ*, though others, by reason of cross-bedding and inclusion of foreign materials, are as obviously derived by slope washing from the adjacent mountain-side.

The individual characteristics of some of the *in situ* air-fall pumices, and thence, if possible, their correlation with some of the already-known sequence of pumices in the motorway sections, hold out the best hope of tying in the Tlapacoya early-man archaeological finds to the relative chronology provided

by the latter. Samples have been taken and it is hoped that the laboratory work on these may provide some qualitative or quantitative features enabling such correlations to be made with some confidence. These would serve as an independent check on dates derived from the internal evidence of the site, which are unlikely to be as categorical as could be wished.

The drawn sections are to scale, but are diagrammatic. No attempt has been made to render great detail, but merely to record the stratigraphical sequence of the volcanic sediments, with enough information about their surroundings to identify them. In particular, the numerous small faults and graben, due to lateral shrinkage, having throws of no more than a few centimetres, have been ignored. Since the pumices and ash-falls, whether subaerial or falling direct into water, are the central subject of interest, the detailed characters of the intervening sediments have not been particularly noted. The vertical geological columns of Trenches I and II amount to 8.4 m. and 11.2 m. respectively.

A layer of well-bedded clean white pumice, 60 cm. thick, which is distinctly tripartite—coarse, fine, coarse—is a prominent feature in both sections. In B.T. I it overlies a very black, humic, lake-clay, of which the surface is eroded. This suggests that the pumice fell on a dry land-surface during an interval of low lake-level, and is *in situ*. A sample from immediately below the 'tripartite' pumice was taken for Radiocarbon dating. The result from this (Geochron. No. GXO 646): $12,900 \pm 400$ years B.P. is in reasonable accord with existing ideas as to the age of early hunter-collector cultures in Mexico. In B.T. II, the obviously corresponding deposit lies upon a slope-washed mixture of derived pumice and soil. This trench is directly opposite to a gully descending the flank of the Cerro from between the two peaks which, we are informed, still sometimes carries water in the rainy season. This accounts for the much more complicated and disturbed stratification in B.T. II. The following details do, however, show correspondences.

At the extreme west (shoreward) end of B.T. I (between 1 and 2 metres along the trench-bottom) there is exposed a 3 cm. thick very clean grey basaltic ash, immediately followed by 30 cm. of coarse white pumice with andesite lapilli which is clearly *in situ*. A similar ash, of the same thickness is seen in B.T. II and, over it, 35 cm. of coarse pumice with andesites, though, in this case, obviously derived. This sequence seems most likely to correspond with that attributed to Popo. on p. 109 hereof.

In B.T. I, the distance horizontally between the summit of the coarse pumice and the base of the 'tripartite' example is just over 10 m.; in B.T. II it is only 6.5 m. Between them lie, in the one case, two water-laid beds of white pumice, in the other only a single such layer, all, apparently, *in situ*. In view of their different situations, these sequences correspond fairly well.

It would be rash, in advance of the petrological results, to attempt firm correlations between the Tlapacoya pumices and those in the motorway sections,

though it seems very likely that the two sequences have some deposits in common. It is, however, permissible to point out the macroscopic resemblances between the coarse pumice-with-andesites and the underlying grey basaltic ash and the products attributed to Popocatepetl, which at so many widespread exposures on both flanks of the Sierra present this sequence. A humic lake-deposit immediately adjacent to the pumice with andesites gave a C^{14} date of $14,700 \pm 280$ years B.P. (Geochron No. GXO 878)

SUMMARY AND CONCLUSIONS

While much still remains to be done, both in the field and the laboratory, as a result of which the tentative conclusions here reached are certain eventually to be subject to changes in detail, some picture of the factual stratigraphical situation has now emerged from the foregoing pages, which, in its broad lines, may be considered as fairly well established.

The C^{14} date for the Río Frío *nuée ardente*, at 35,000+ years B.P., gives one firmly fixed point of departure. This shows that, in the present state of our knowledge of early man in the Americas, only deposits lying well above the *nuée* in the stratigraphical column may be directly relatable to evidences of human occupation in the Basins of Mexico and Puebla. This does not entirely rule out the usefulness of some older deposits and weathering-horizons here described, for if, over much of the transect, directly-correlatable materials of possibly archaeological age may be missing, the more ancient levels may nevertheless serve to indicate, if only approximately, the position at intermediate points of the critical *nuée* horizon.

Since the deposits of the *nuée* itself appear to be confined to the immediate vicinity of the ancient volcanoes of Telapón and Tlaloc, and the underlying Younger Lavas to that of Papayo, it is the much more widespread and readily-recognized summit of the red-soil series that will best mark the lower boundary of our archaeological interest in most places. Whatever the environmental circumstances necessary for the formation of the red soils (and the investigation of this calls for the results of laboratory work not yet completed), it is plain that they have not prevailed in later times, for neither the present-day soils, nor any demonstrably later than the *nuée*, in the area of its occurrence, display the characteristic red colouring. This is certainly the case at some height in the Sierra. Whether it is so also in the much lower-lying Atoyac Valley of Puebla is not so certain, for, though there is no late red-weathering horizon there as intense as the 'marker' (or even the 'first red' soil) of the motorway sections, the uppermost of the 'hard tops', as at Site X, is distinctly reddened at its summit, and similar horizons, possibly corresponding with this, appear elsewhere in the Puebla region.

Owing to mistaken preconceptions as to the time-scale involved, upset by the surprisingly high C^{14} date for the Río Frío *nuée*, the latest deposits—those above the *nuée*—had not hitherto received the attention which they deserved. During the one week's visit of the writer in November, 1966, a small number of exposures of these was found and noted, but, owing to shortage of time, neither thoroughly studied and drawn to scale nor sampled. Since these exposures appear above the Papayo ('Younger') Lava, mostly near Río Frío, they have been grouped separately as the 'Río Frío Series', including everything above the lava from the *nuée* to the modern surface.

Diagrammatic sections of nearly all the sites studied, more or less to scale, have been prepared from projected colour-transparencies and checked by actual measurements and notes of the deposits accessible to close inspection. In some cases, however, details are not visible without extensive cleaning of the weathered and rain-washed sections, so that there may well be characteristic pumices present in some which have escaped observation. The *absence* of such details is not always significant, therefore: their presence, where shown, has been checked by close inspection on the spot, or they appear clearly on the photographs as continuations of such confirmed exposures.

These drawn sections are presented, in order as they occur along our transect, and correspondences and tentative correlations between them are suggested. These may not all be borne out by the eventual laboratory results, but are the best that can be suggested at present, using stratigraphical and macroscopic criteria only.

There remains a long gap, of some 40 km., between Sites N and Q, in which there are only very shallow sections in the thick alluvia along the motorway. Correlation across this is, at present, only very speculative, but it may be hoped that the upper deposits in the many deep barranca-sections on the lower eastern slopes of Popo. and Iztac., mostly far from made roads and accessible only with difficulty, will provide some links. The characteristic and late pumice-with-andesites in the Río Frío Series, apparently emanating from Popo., is one feature which should be specially sought there. It is possible that it may be recognizable for at least some distance to the east, in the Valley of Puebla, and so tie in the Pleistocene sections recorded there, which have some internal correspondences, as indicated in the diagrams.

In particular, some andesitic pumices containing large crystals of biotite are prominent features of many sections east of Site Q. While this was, at first, thought to be an unique phenomenon, at least two pumices in the Río Frío Series (θ, ι) have proved to contain this mineral, though in smaller quantities and in much tinier crystals. Further, Prof. Sotomayor's first mineralogical examinations of samples show that several deposits, not all pumiceous, from the Tetela Road barrancas (Site X) also contain biotite, in addition to the single pumice in which it was macroscopically identified there. While significant to

some extent, therefore, this feature cannot, as had been hoped, be used finally to establish identity between two deposits, especially when they come from sites lying a considerable distance apart. The relatively coarse pumices-with-biotite found near Puebla may well have a source to the east, quite different from those of the Sierra Nevada. This calls for exploration of a much wider area than has so far been undertaken.

The geological histories of the Sierra Nevada and of the plain of Puebla, as shown by the sections studied, cannot yet be correlated with any confidence.

In the Sierra, the surface of the Older Lava series was deeply weathered and dissected by streams which, today, are still flowing in approximately the same courses. On this surface was deposited a thick series (26 metres have been measured) of fine volcanic ashes, mainly of basaltic character, interspersed here and there by andesitic pumices. The deposits lie conformably on the pre-existing topography, which is the chief reason why they were at first thought to be much younger than has proved to be the case.

There were several intervals of volcanic quiescence, during which relatively mature red soils were formed at the free surfaces of the ash-falls. In the sections seen, there is surprisingly little evidence of concurrent denudation, which leads to the suspicion that, during phases of soil-formation there may have existed a close cover of vegetation. About half way up the column there was a relatively long interval with intense chemical weathering, which resulted in the formation of the 'marker'-soil—deep red in colour and more than 1 m. thick. At only one site (E), nearly all of the deposits, including the 'marker'-soil and much of what lies beneath it, were removed on one steep slope by erosion. After this, renewed volcanic activity laid down, with only slight pauses, several metres of ash and pumice, conforming with the new, eroded, slope at Site E. The quiet intervals increased towards the end of this phase, for several minor weatherings near the summit of the deposits culminate in a well-developed, constantly recurring 'first red' (from the top!) soil. Since this weathering, the conditions for red-soil formation gradually ceased to prevail. There is one more small soil above the 'first red' at Site M and elsewhere, but in the mountains at least they do not seem to recur thereafter.

The whole ash, pumice and red-soil series was next overflowed almost everywhere near Río Frío by a series of lava-flows, multiple, no doubt, but, in terms of chronology, essentially forming a single event—the Younger Lava. The lavas apparently emanated from the dome of Cerro Papayo, the present highest point on the pass. They make the present-day topography of the higher parts, but have not altered that of the lower slopes, beyond their reach, where the red-soil series still crops out at the surface in many places. The topography here, therefore, remains that of the Older Lava and its conforming red-soil mantle.

A tremendous *nuée ardente*, apparently from the north, i.e. with Telapón or Tlaloc as its probable source, poured down the Río Frío valley shortly after

the Lava, on which it lies directly wherever the lava is present. The deposits of this, at least 6-7 m. thick in the valley itself, where its base remains unseen, spread more thinly far beyond its flanks, where it appears as our Pumice θ , often in thicknesses of only a few centimetres. Where the lava is absent, as at Site M, Pumice θ lies on the surface of the small soil just above the First Red Soil. The *nuée* is dated by its contained carbonized timber to 35,000+ years B.P.

Shortly after the fall of the *nuée*, there appear signs of extensive erosion by rainwash, with deposits of lahars or mudflows, beds of redeposited gravel &c. Some of these last may even be the results of local solifluction (Sites K, Río Frío I, O). These phenomena are to be seen not only on the pass and down into the valley of Puebla, but are also conspicuous on the flanks of the Chalco and Texcoco basins, though only mentioned in passing here. Over most of the 40 km. stretch of the motorway between Sites O and Q, such deposits blanket everything of earlier date.

Two or three rather distant pumice-explosions followed at intervals, represented by the thin, fine pumices (1) intercalated with the 2 m. or so of loose yellow ash which almost everywhere overlie the *nuée* deposits.

Almost the final distinguishable and widespread volcanic event, now dated to about $14,700 \pm 280$ years B.P., is the explosion, apparently of Popo., which yielded the very characteristic pumice-with-andesites found near the summit of the Río Frío Series. The vertical thickness of post-*nuée* volcanic deposits amounts to no more than 4 m. at any site so far seen.

The history of the Atoyac valley, represented by the nine sites described and others seen only cursorily, is at present far less clear. An entirely different environment is represented. Far from high mountains, the plain of the Basin lies some 1,040 m. lower than the summit of the pass at Río Frío. Average temperatures, therefore, can be expected to stand some 10°C higher, if the lapse-rate is normal. Rainfall, owing to the rain-shadow effect of the seaward scarp of the Altiplano, is markedly less and evaporation-rate higher, so that the Valsequillo region is, today, markedly arid. Most of the sections exposed are in areas of recent Badlands-type gully-erosion. Though the greater part of the deposits seems to consist of airborne pyroclastic sediments, they are, on the whole, much finer in grade than those nearer to the vents producing them. An exception is the '*xalnene*', which is quite local in origin. Apart from this one case, sandy to gravelly pumices are here much less prominent.

At least once within the times that here concern us the Atoyac valley was blocked, near Valsequillo, by a lava-flow from the Cerro Colorado. As a result, a lake was dammed up to much the same height and lateral extent as the present artificial lake. Thus, at least some of the deposits may be lacustrine, though most, their bedding conforming closely to slopes up to 5° , can hardly be so, in view of their fineness and because several subaerial soils seem to have been formed on them at various stages of their deposition.

At several sites there is a strikingly red bed (apparently a soil) near the base of the sequence and on this, to the north of the City of Puebla there often lies a coarse-sandy pumice-with-biotite (Sites Q, R, S, T, U, V). In many cases, this is immediately, or shortly, followed by mudflows with boulders and evidence, in redeposited pumices and other volcanic materials, of much-increased water-action. At Sites W, X and Y, these last are absent, as are the sand-grade pumices. Sites W and X, however, have each a red bed at the base. This has not been seen at Site Y, but doubtless occurs at a depth greater than that exposed, for in all other respects the stratigraphy here closely resembles the upper part of that at Site X, 2 km. away, on the other side of the water.

The red beds have a family likeness to the red soils described from the motorway sections and probably denote similar formative conditions. It has been said that the red bed at Valsequillo is a tuff from a local vent. This may be so, but the same vent can hardly have provided the very similar bed at Site Q! The redness, even to the naked eye or a hand-lens is due to more or less dehydrated interstitial colloids and must be secondary to the deposition of the mineral grains, whatever their origins. This feature is common to all so far examined in the hand. The redness is therefore likely to be the result of an environmental influence common to all, whatever the nature of the raw materials on which it acted. If, as may be supposed, there is a strong climatic factor in the formation of red soils, the last of these to be found in any sequence should be approximately contemporary with the last in every other geological sequence in the same climatic region, bearing in mind that absolute contemporaneity would depend upon the rather unlikely simultaneity of deposition of the parent materials.

The Tetela Road *barrancas* (erosion-gullies) (Site X) provide the most detailed sections.

The earliest deposit exposed is a dark brown lacustrine clay, unfossiliferous, which lies with a shoreward feather-edge on the Cretaceous limestone-breccia. Where exposed on the north shore of the present-day lake it is at least 3–4 m. thick. There followed a local (Cerro Colorado) volcanic explosion which deposited the *xalnene*, possibly in water, but if so only locally. This, in turn is covered by 2.5 m. of sandy, buff-coloured ash, now hardened into a step which forms the cornice of the lake shore-cliff on that side. On it lies the red bed, itself probably originally a pale-coloured sandy tuff, now deeply weathered in 'red-soil' environmental conditions. It is also hardened, by precipitation, and perhaps dehydration, of iron colloids in its interstices.

There follows a threefold cyclic series of deposits—colloidal clay topped by what appear to be weathering-soils, the latter more resistant to erosion and standing out in relief as rounded steps in the sections. The clays might be water-laid, but show no internal stratification and, moreover, lie on a 5° E.-W. slope. They are, therefore, for the time being most reasonably explained as air-fall

volcanic ashes, chemically altered *in situ*. A much moister climate than that of the present day would be demanded for such intense alteration to be possible. The 'hard caps' near the top of the sections, occasionally with a reddish weathering at their summits, exhibit far less intense chemical weathering.

The succession would seem to justify an indication of climatic change since the last red-soil horizon—warm/dry through cool/moist back to the present-day warm/dry conditions. The confirmation (or denial!) of this hypothesis will depend upon the laboratory results, but this tentative impression would not be at variance with that suggesting increased water-action in the cooler and moister mountain environment near Río Frío, following the *nuée ardente* incident.

The deposits at Sites X and Y which have yielded palaeontological and archaeological evidences are confined to the fillings of several watercourses, apparently ponded back by a rise of the local base-level afforded by the former lake-surface. At Site X, the cut-and-fill took place towards the end of the second cycle of deposition and the fossiliferous deposits are sealed by a layer of fine pumice-with-biotite. Since the red bed is not visible at Site Y, the particular part of the cycle to which the fossiliferous bed should be assigned cannot be decided, but here, too, it is sealed by an extremely fine pumice-with-biotite laid down in still water. There can be little doubt that these two horizons, within a couple of kilometres of each other, represent essentially the same interval of time. This falls between the weathering of the red bed and the formation of the two 'hard caps' of consolidated ash which, apart from the modern soil, top the section. Their position is not inconsistent with the above rough working hypothesis, that the parts of the Site X and Y sections above the red bed correspond with the Río Frío Series in the mountain environment.

The correlation of the Tlapacoya (Site Z) Boundary-Trenches with the general succession rests, at present, on the possible identity of the coarse pumice-with-andesites, there, with Pumice κ of the Río Frío Series. The conditions of preservation among gently-sedimenting lake-deposits have favoured the survival in recognizable condition of even very slight traces of intrusive volcanic materials at Tlapacoya while, in the often steep, mountainous sites near Río Frío there has frequently been erosion and re-working of slope-deposits on a scale sufficient to obliterate all but the most well-marked and characteristic pumice-beds. One may, nevertheless, still hope to recognize at least the fairly thick 'Tripartite' pumice above the horizon of Pumice κ . This would clinch the identification of Pumice κ with the Tlapacoya pumice-with-andesites. In that case, the fine pumices intervening, in B.T. II, between the pumice-with-andesites and the underlying grey sandy pumice near the base, might be held to correspond to the two or more fine pumices called 'i' in the Río Frío Series and the grey-sandy itself to Pumice θ . Confirmation of this will rest on their mineral compositions, but without this purely stratigraphical hypothesis it is doubtful whether they would even have been compared.

In conclusion: we have, here, recorded a considerable mass of new facts. It will be obvious that, by confining our attention to narrow transects, mainly along the roadways, we have not yet seen more than a small fraction of the potentially-available evidence. To reach firm conclusions at this stage would be hazardous, but the formulation of some working hypotheses is the necessary prelude to the next practical steps. Without this, the information already assembled cannot be organized to suggest what we should now most pressingly seek to confirm, or where best to look for fresh evidence.³

ACKNOWLEDGEMENTS

Thanks are due for financial help, both for return air-travel to, and maintenance in, Mexico, received from the British Council and the Central Research Fund of the University of London. Without this the visit would have been impossible.

I also gratefully acknowledge the unstinting help, in providing transport, lending equipment and assigning field-assistants, of Sr. Arq. Prof. J.-L. Lorenzo, Chief of the Dept. of Prehistory of the Instituto Nacional de Antropología e Historia.

In the field, I have had the advantage of the company and invaluable vulcanological advice of Sr. Ir. F. Mooser, of the Comisión Federal de Electricidad.

³ The preliminary work, of which this paper is an account, was followed in January-March 1968, by a further season's fieldwork and study of laboratory results from samples taken both in the 1964 and 1968 seasons. The conclusions from these will be published in the next Number of the *Bulletin*.

Book Reviews

NARR, Karl J. *ed. Handbuch der Urgeschichte Vol. I: 'Ältere und Mittlere Steinzeit: Jäger und Sammlerkulturen*, Bern & Munich, Francke Verlag, 1966. 507 pp. 22 pls. 100 figs.

The reader for whom this volume, the first of three, is chiefly intended, is the 'educated layman'. Hence the plan and proportions of the book, with extensive use of ethnographic parallels, and much fuller treatment of such aspects as art and religious beliefs than of the more intractable material remains. Unfortunately, as a result, the more technical contributions, such as regional surveys of sites and industries, are crowded with an indigestible array of facts, baffling to the beginner, while prolixity is tolerated elsewhere: 6,000 words on the Spiritual Life of Later Palaeolithic Man, but no full description, let alone illustration, of the hand-axe sequence. Even the amateur would have benefited had the references to modern primitive societies been confined to a few recommendations in the excellent annotated bibliography and the fifty pages saved devoted to less accessible subjects. These should have included technology, raw materials, fauna, vegetation and climate, especially glacial phenomena, which are scarcely touched on or completely ignored.

The Handbook, however, has its merits. The temptation to overstress the importance of Europe, and of France in particular, during this period, has been resisted; its conclusions reflect enlightened common-sense and cautious scepticism and avoid dogmatism. The student of prehistory will find the regional surveys by Müller-Beck, Klima and Bandi very valuable, particularly where they concern Central and Eastern Europe, areas about which little has been written in English or French. Almagro's contribution on Upper Palaeolithic art, though conservative in interpretation, is lucid and complete, while Kurth and Hebezer provide an admirable summary of the palaeo-anthropological background from *Pithecanthropus* to the appearance of *Homo Sapiens*.

CRESSIDA RIDLEY

CALDWELL, J. R. *ed. New Roads to Yesterday*. Essays in archaeology. London, Thames and Hudson, 1966, 546 pp., fully illustrated, 84s.

This is a collection of articles, originally having appeared in *Science* magazine, on a wide variety of archaeological and related subjects, with an Introduction by the Editor which serves to bind them together.

The writers are almost all leading North American specialists in their fields and each article forms a brief, but authoritative and up-to-date, synthesis of its subject. Liberal notes and references guide the interested reader into the original literature.

Four main headings are represented: Old-World and New-World Prehistory, settled civilizations of the Near and Middle East and Science in Archaeology.

Obviously, in such a wide field, any one archaeological reader is bound to have his particular, more or less narrow or wide, area of interest; perhaps also specialist knowledge and critical faculty. Outside that, he will find expositions, in subjects about which he may know very little, which outline the extent of our present knowledge (and ignorance!) in terms comprehensible to all.

Space does not allow a review of all the contents. The contributions of Clark Howell (the Villafranchian), Karl Butzer (Archaeology and geology in Egypt), James Griffin (Asiatic connections with the New World), Michael Coe and Kent Flannery (Micro-environment and Meso-American Pre history) and M. Evenari *et al.* (Ancient agriculture in the Negev) were of particular interest to this reviewer, but every one was read with profit.

BOOK REVIEWS

Science, as such, is much under-represented by the single article, on flint-patination, by V. J. Hurst and A. R. Kelly, which, besides being over short and sketchy, is inadequately documented and even, in places, erroneous. It is clear that the large European literature on the subject was unknown to, or disregarded by, the writers. The collection would have been better, either without this, or with space under this head comparable in size to the other sections. Surely, the point is that Science plays a part—often a large one—in every one of the other articles?

The book represents a synthesis well worth making and it would be hard to believe that any reader could go right through it without meeting a good deal that was entirely new to him.

I. W. CORNWALL

ALLCHIN, Bridget. *The Stone-tipped Arrow: late Stone Age Hunters of the Tropical Old World*. London, Phoenix House, 1966. xii, 224 pp. 16 pls. 43 figs. 4 maps. 84s.

This is a descriptive and interpretative study of a number of post-Pleistocene industries ranging in time and space from the Stillbay and Magosian of Africa down to recent stone tools in Australia; the regions covered embrace southern and equatorial Africa, northern and southern India, Ceylon and other Asiatic islands, and Australia. For her basic archaeological data the author utilizes the excavation results of many workers, to the interpretation of which she brings a fresh and penetrating insight stemming from a controlled use of ethnographic parallels and the reports of anthropologists and early travellers.

Although Dr. Allchin was necessarily selective in her choice of subjects, it is surprising how many industries she has managed to include. These she relates to certain rainfall zones or 'islands' in her main regions, and makes valuable suggestions concerning the likelihood that climatic factors may have determined the type of individual industries, whether in Africa, Asia or Australia; but how far it is always valid to extrapolate from present conditions is perhaps another matter.

To some extent the same may be said of the author's tentative linking of certain stone age artifact types, etc., with those used by modern tribes: for example, she refers to the possibility that the modern Kamba (Kenya) method of hafting small iron adzes may have been inherited from the 'wood-working' Tshitoliens of the late stone age. Yet stone adzes are not characteristic of the Tshitolian and the *petits tranchets* are transverse arrowheads. It may be added that Professor J. Desmond Clark has made the same tentative link between Tshitolian tranchets and adze-like tools of the modern Chokwe and Lunda in Angola. Without wishing to raise the thorny question of evolution *contra* diffusion, surely similar simple needs could lead to the making of similar tools and methods of using them almost anywhere.

The use of ethnographic material to interpret the past must inevitably involve an element of subjectivity, but even with this consideration in mind, this is a highly competent, thought-provoking and valuable contribution to prehistoric studies. The book is excellently illustrated and finely produced.

T. P. O'BRIEN

PHILLIPS, Wendell. *Unknown Oman*. Longmans, Green and Co., 1966, 319 pp. 24 pls. 5 maps. 42s.

This is a much more illuminating work on the subject of that little known strip of land along the southern coast of the Arabian peninsula than Dr. Phillips' previous work, *Qataban and Sheba*. Dr. Phillips is one of the few scholars to ever explore the area of Arabian land where civilization has virtually stood still for centuries. He has been interested in this area since 1952, when he led an expedition to Timna in South Arabia and then into the Yemen, where he partially excavated at Marib the site reputed to be the capital of the Biblical Queen of Sheba. Due to dangerous conditions that

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developed between his team and the local Yemeni officials, he was forced to abandon the site, leaving behind all his equipment and most of his finds. He then undertook an expedition to Oman in 1958 at the kind invitation of the Sultan himself.

Here in Oman was found a culture that has not been influenced to any great extent by Western man. Dr. Phillips shows a clear insight into the ways of these people. He has lived and worked with them, and at times he has almost given battle to them. Not only has he mixed with the common people, but he has built a lasting friendship with the Sultan of Oman, Said bin Taimur, who, to express his trust in Dr. Phillips, granted him the exclusive right to explore and prospect for oil in his country.

Though his previous work dealt mainly with his own experiences, this new work perhaps illustrates a growing knowledge of the Omani Arab, for he goes into a great deal of detail on the customs, religion, disease and medicine, slavery and geography of the land. He backs up his work with ample notes, bibliography and an appendix explaining how he achieved oil concessions.

Though the text is a bit broken at times, his first-hand account makes for very pleasurable reading. Especially exciting is the account of his search for the legendary city of Ubar, an Omani 'Sodom-and-Gomorrhah'. Did he find it? Perhaps not, but his discoveries probably clear up a lot of the mystery created from earlier reports of siting this desert city.

ROBERT R. HURST, JR.

SCHWARZ, Georg T. *Archaeologische Feldmethode*. Thun & München, Ot Verlag, 1967. 220 pp. Illustrated. DM 24.80.

This is an essentially practical book, on how to set about (and carry to completion!) an archaeological task, whether of exploration and location or of excavation, with the appropriate methods of recording, consultation with specialists, exposition and publication of the results.

About the first one third deals with Field Archaeology and both the writer's expressed comments and the references which he cites show how far he is indebted for his ideas of archaeology, both without and with excavation, to British workers. He confesses that this aspect of the subject has, in the past, been practically ignored in Switzerland and Germany, as have the potentialities of the instructed amateur archaeologist, in contrast with the mere collector. Much of what he has to say in the way of generalities, therefore, will not be new to many British readers, but is interesting, to see through Central European eyes and bears repetition in another major world language.

Survey, instruments, notebooks, techniques and records are all simply and fully described in due order, with hints on drawing objects, photography, section-drawing and site-planning—right up to the finished publication.

Several appendices give lists of necessary equipment and materials and these are right up to date. The classified lists of relevant books and publications include a flattering number of British titles.

In all, a simple, compact text, well illustrated, full of useful information for an intending field archaeologist, with sound tips from an evidently experienced practitioner. Most of us could learn something from it outside our own specialities.

I. W. CORNWALL

BOOKS RECEIVED

The following books have been received. The fact that they are listed here does not preclude their review in a later issue:

BASS, G.	Archaeology Underwater London, Thames & Hudson, 1966	35s.
CLARK, G.	The Stone Age Hunters London, Thames & Hudson, 1967	30s.
COE, M. D.	The Maya London, Thames & Hudson, 1966	35s.
COON, C.	The Living Races of Man London, Cape, 1966	70s.
CULICAN, W.	The First Merchant Venturers London, Thames & Hudson, 1966	30s.
HOULDER, C. & MANNING, W. H.	South Wales (Regional Archaeologies) London, Cory Adams & Mackay, 1966	16s.
LUNDMAN, B.	Geographische Anthropologie Stuttgart, Fischer, 1967	DM.38
MACDONALD, A. H.	Republican Rome London, Thames & Hudson, 1966	35s.
MAJUMDAR, G. S. & RAJAGURU, S. N.	Ashmound excavations at Kupgal Deccan College, 1967	Rs. 20
MEGGERS, B.	Ecuador London, Thames & Hudson, 1966	35s.
OAKLEY, K. P.	Frameworks for dating fossil man 2nd edition, London, 1966	45s.
PIOTROVSKY, B. B.	Il regno di van Urartu Rome, Ateneo, 1966 (Incunabula Graeca XII)	Li. 8,000
POTRATZ, J.	Die Pferdetrenzen des alten orientis Rome, Pontifical Biblical Institute, 1966 (Analecta Orientalia 41)	Li. 18000
POWELL, T. G. E.	Prehistoric Art London, Thames & Hudson, 1966	35s.
SCHWARZ, G. T.	Archäologische Feldmethode Thun, Ott Verlag, 1967	DM.24.80
SCOTT, J. S.	Southwest Scotland (Regional Archaeologies) London, Cory Adams & Mackay, 1966	16s.
SQUARCIAPINO, M. F.	Leptis Magna Basel, Roggi, 1966 (Ruinenstädte Nordafrikas No. 2)	DM.16
THOMPSON, M. W.	Novgorod the Great London, Evelyn, Adams & Mackay, 1967	70s.

INSTITUTE OF ARCHAEOLOGY

Twenty-third ANNUAL REPORT

1 August 1965 — 31 July 1966

INSTITUTE OF ARCHAEOLOGY

COMMITTEE OF MANAGEMENT

THE VICE-CHANCELLOR (Sir Thomas Creed)

THE CHAIRMAN OF CONVOCATION (Dr. C. F. Harris)

THE PRINCIPAL (Sir Douglas Logan)

The Director of the Institute (Professor W. F. Grimes) *

The Director of the Courtauld Institute of Art (or other representative) (Professor G. Zarnecki)

The Director of the Institute of Classical Studies (Professor R. P. Winnington Ingram)

The Director of the Warburg Institute (Professor E. H. J. Gombrich)

The President of the Council for British Archaeology (or other representative) (Dr. D. B. Harden)

The President of the Prehistoric Society (or other representative) (Dr. J. D. Cowen) *

The President of the Society of Antiquaries of London (or other representative) (Sir Mortimer Wheeler)

Recognised or Appointed Teachers in cognate subjects, or Heads of Schools or Institutes in the University:—

Professor K. de B. Codrington

Dr. P. S. Noble

Professor P. E. Corbett

Professor A. H. Smith

Professor W. B. Emery

(Two vacancies)

Professor C. Daryll Forde *

Two members of the non-professorial staff nominated by the non-professorial staff through the Academic Board:—

Dr. I. W. Cornwall

Mr. H. W. M. Hodges

The four Professorial Heads of Department of the Institute of Archaeology (ex officio):—

Professor G. W. Dimbleby *

Professor S. S. Frere

Professor J. D. Evans

Professor S. H. F. Lloyd

Five other persons:—

Mr. R. L. S. Bruce-Mitford

Sir Eric Fletcher

Professor J. G. D. Clark

Professor D. McKie

Mr. A. R. Dufty

Dr. P. S. Noble acted as Chairman throughout the session

* Members of the Financial Sub-Committee

REPORT OF THE DIRECTOR FOR THE SESSION 1965/66

ADMINISTRATION

Director: Professor W. F. Grimes, C.B.E., M.A., D.Litt., F.S.A., F.M.A. (A.T.) *

Secretary and Registrar: E. Pyddoke, F.S.A.

Director's Secretary: Mrs. M. Hunt

Senior Executive Officer: Miss M. F. Varese

Secretarial Assistant: Miss H. I. Fuller

Staff matters

The Director continued to serve as Chairman of the Council for British Archaeology Committees on Ancient Agriculture and on Industrial Archaeology, the London Topographical Society, the Finance and Administrative Committee of the Field Studies Council, and the Faculty of Archaeology, History and Letters of the British School at Rome. He was elected Chairman of the Field Studies Council and of the Deserted Medieval Villages Research Group. He continued to act as Honorary Treasurer of the Council for British Archaeology and as a member of the Royal Commission on Historical Monuments (England), the Ancient Monuments Boards for England and Wales and the Royal Commission on Ancient Monuments in Wales and Monmouthshire. He continued to represent the University on the Roman and Mediaeval London Excavation Council and was appointed representative on the Council of the London Society and the Council of the Area Museums Service for South-eastern England. He was appointed a member of a special Committee set up by the Ministry of Public Building and Works to investigate and report on matters to do with the preservation of Field Monuments.

The Director represented the University at the VIIth International Congress of Prehistoric and Protohistoric Sciences at Prague in August. This Congress was attended on behalf of the Institute by Professor Evans, who read two papers, Dr. Hodson and Mr. Nandris, who each read a paper, and Mr. Beeby.

Dr. Sulimirski represented the Institute and read a paper at the First International Congress of Slavonic Archaeology in Warsaw in September.

Miss Parker and Mrs. Maxwell-Hyslop attended the *Rencontre Assyriologique* at Liège in July.

Three members of the staff left the Institute at the end of the Session. Professor K. de B. Codrington, Professor of Indian Archaeology, retired and was granted the title of Professor Emeritus.

Professor Codrington joined the Committee of Management of the Institute in 1944. He was appointed to the Chair of Indian Archaeology jointly at the Institute and

*A.T. Appointed Teacher, R.T. Recognised Teacher of the University of London, throughout.

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at the School of Oriental and African Studies in 1948. Professor Codrington made a many-sided contribution to the work of the Institute, not least in the advocacy of a broad approach to the study of archaeology, with a full awareness of the inter-relationships of the different fields.

Professor S. S. Frere resigned to take up appointment to the Chair of the Archaeology of the Roman Empire in the University of Oxford.

Professor Frere was appointed Reader in the Archaeology of the Roman Provinces in 1955 and became Professor in 1963. During his time at the Institute he combined unremitting attention to teaching and supervision of research in an expanding department with great activity in personal research, in Britain and in Gaul, on a number of important sites, which have made or will make outstanding contributions to knowledge of his period.

Dr. T. Sulimirski also retired from his part-time appointment as Special Lecturer in Central and East European Archaeology.

Dr. Sulimirski had been associated with the Institute for some years as a regular lecturer on eastern European topics before in 1958 he was appointed Special Lecturer. He continues to assist the Institute and has undertaken to produce a series of surveys of recent work in Russian archaeology, the first of which will appear in the forthcoming *Bulletin* of the Institute.

During the year Professor Frere was appointed a member of the Royal Commission on Historical Monuments (England) and of the Ancient Monuments Board for England.

Mr. P. J. Parr was appointed a Recognised Teacher of the University.

Mr. J. Nandris was appointed Assistant Lecturer in the Prehistoric Department.

Mr. B. M. Beeby, Chief Library Assistant, was awarded the Post-graduate Diploma in Prehistoric Archaeology.

During the Autumn term Mr. S. K. Matthews, head of the department of Photography at Ealing Technical College, came as Visiting Lecturer to lecture on the theoretical aspects of photography. He also advised during the session on photographic matters generally.

In April a one-day symposium on the Mosaics of Roman Britain was held at the Institute, at which the Chair was taken by Professor J. M. C. Toynbee and Professor Frere.

Visiting Scholars

Among Scholars who visited the Institute were Dr. Y. Aharoni and Mr. D. Barag (Hebrew University of Jerusalem), Professor M. Tosun (Ankara University), Dr. and Mrs. Doltan (Israel) and Dr. W. Dever (America).

REPORT OF THE DIRECTOR FOR THE SESSION 1965/66

Public Lecturers and Exhibitions

The Special University Lectures were given during the Spring Term by Professor Holger Arbman, who took as his general subject 'Early German Animal Style in the 5th-7th Centuries A.D.', the lectures being entitled 'England and Scandinavia in the 5th and 6th centuries', 'Scandinavia in the 7th century' and 'The late Vendel style in Scandinavia and its relationships with the Continent and the British Isles'. Attendances averaged 116.

A variety of different topics was dealt with during the session in a total of 14 public lectures. Attendances averaged 92. The lectures included Professor P. L. Shinnie (University of Ghana), Dr. Vasson Karageorghis (Department of Antiquities, Nicosia), Miss Honor Frost, Mr. J. Mellaart, Professor Evans and Mr. A. C. Renfrew (University of Cambridge), Mr. D. H. French and Mr. C. A. Burney (University of Manchester). The lectures by Mr. Mellaart and Mr. French were jointly sponsored with the British Institute of Archaeology in Ankara; that by Professor Evans and Mr. Renfrew with the British School at Athens.

Small exhibitions held during the year in the Entrance Hall included a display of drawings of wall-paintings from Çatal Hüyük; equipment used on excavations; publications on underwater archaeology; as well as the annual exhibition of students' photographic work.

The Institute continued to co-operate with the Extra-Mural Department in teaching for the University Extension Diploma in Archaeology. A number of the courses were again held in the building and among the lecturers were a member of staff, Mr. B. M. Beeby and past students Dr. M. V. Seton Williams, Mrs. E. Guinard, Dr. G. Wainwright and Mr. G. Jarvis. The Director and Mr. Parr acted as External Examiners.

Students

The total number of students registered at the Institute during the session was 125; in addition 67 Intercollegiate students attended courses. Institute students included 28 who were registered for Diplomas (4 part-time); 43 for Higher Degrees (8 part-time); 19 for the Course in Archaeological Conservation (2 part-time); and 7 for the Course in the Conservation of Historical Monuments (of whom 2 were Occasional students). Eight full-time Occasional students and 20 Occasional students attended lectures and used the facilities of the Institute.

Five students were awarded the Diploma in European Archaeology (Section B1: Iron Age and Roman Provinces); two the Diploma in Prehistoric Archaeology; three the Diploma in the Archaeology of Western Asia, one in A (Mesopotamia) and two in B (Palestine).

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Of the 43 Higher Degree students, 20 were registered for the Ph.D. full-time (3 in the Faculty of Science) and 3 part-time. Twelve were registered for the M.A. full-time and 4 part-time and 3 were registered for the M.Phil. full-time and 1 part-time. Five Ph.D.s were awarded: to Miss I. A. R. Naik (Indian Department) in March, to Mr. G. Rosselló (Prehistoric Department) in May and to Mr. T. C. Sharma (Indian Department), Miss C. Goff (Western Asiatic Department) and Mrs. B. P. Rosselló (Prehistoric Department) in July. The M.A. degree was awarded to Miss A. V. Akeroyd (Human Environment Department) in July with a mark of Distinction and Miss I. M. Davies (Prehistoric Department) was awarded the M.Phil. degree, the award to be effective from July, 1967.

Six students qualified for the Institute's internal Diploma in Conservation (two with Distinction) and two for the Diploma in the Conservation of Historical Monuments.

A total of 23 overseas countries were represented among students registered at the Institute as follows: Aden, 1; Australia, 2; Belgium, 1; Canada, 2; Ceylon, 1; Denmark, 1; Germany, 1; Greece, 1; India, 5; Jordan, 2; Lebanon, 1; Mexico, 2; Netherlands, 3; New Zealand, 2; Nigeria, 1; Norway, 1; Poland, 1; Spain, 1; Sweden, 1; Trinidad, 1; Turkey, 1; U.S.A., 19; Zambia, 1.

Gifts

Mr. J. E. Jurriaanse made a gift of £100 to the Institute. Dr. M. V. Seton Williams presented a quantity of excavating equipment.

A collection of Neolithic flints from Hurst Fen, Eriswell, Suffolk was given by Dr. H. A. Fawcett to be added to the pottery from the same site which he presented some years ago.

Gordon Childe Prize and Bequest Fund

Gordon Childe Prizes for 1965/66 were awarded to Miss A. V. Akeroyd, Department of Human Environment, and to Mr. T. C. Sharma, Department of Indian Archaeology.

Grants from the Bequest Fund were made to Miss J. du Plat Taylor and Dr. B. S. J. Isserlin for their work at Motya; to Professor Lloyd towards the second season of his excavation at Kayalidere; to Miss C. Goff towards an excavation at Baba Jan; to Miss B. Bender for research into the Neolithic of Normandy; to Mr. J. Mellaart for his excavation at Çatal Hüyük; and to Mr. G. Rossello towards field-work in Majorca.

Margary Fund

Fifteen students received awards to enable them to visit Continental museums and take part in field work in Greece, Jordan, Turkey and Czechoslovakia.

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TRAINING AND RESEARCH

Institute Field Course

The Stockton course was again in abeyance. A combined environmental and archaeological course based on Alfriston in Sussex was held in June, the environmental aspects of which were dealt with by Professor Dimbleby and Dr. Cornwall, the Director, Mr. Hodges and Mr. Pyddoke covering the archaeological and topographical sides. The Institute's thanks are due to Mr. James Money and to Mr. Eric Holden for their help in connexion with the course, which, as a first experiment in the area covering the North and South Downs and the Weald was a marked success.

Research in Archaeology and Related Subjects

Last year was a time of reorganisation and administration for the Seminar. It was decided to recirculate members of the Seminar to get new ideas for topics to be discussed, new papers offered and new young research members.

The success of this exercise was considerable: membership of the Seminar is now more than 250. Four meetings are firmly fixed for October—December 1966 and five more arranged for January—June 1967. There are also tentative arrangements for another day-meeting in 1967.

During the past year Henry Cleere addressed the Seminar (with Dr. R. E. Tylecote in the chair) on the subject of Early Iron Industries. The meeting stimulated prolonged discussion about the practical and theoretical problems involved in the recognition of evidence for early smelting.

The Institute is grateful to Professor Dimbleby, Dr. P. J. Ucko of University College and Mr. Hodges for organising these very successful activities.

Motya

The investigation of this site, undertaken jointly with the University of Leeds, was continued in 1965-6. Miss Taylor spent some days in the Spring studying comparative material in Tunis before joining a party which spent three weeks working on Greek, Punic and local pottery and on the bones from the site. Dr. Isserlin, assisted by Dr. and Mrs. Pike, completed the resistivity survey and was able to do further work on plans and records. The permit to excavate in 1966 was not granted.

Underwater Research Group

The group was reconstituted in December, Miss Taylor retaining direction until the appointment of Miss H. Wylde as leader in January. Miss G. Wever acted as secretary, Miss M. Varese as finance officer (responsible to the Secretary of the Institute) and Mr. P. Norfolk as equipment officer.

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Bath and diving training was given to students and talks and film shows were arranged. Sea training and exploration experience were made available by the Southsea Branch of the British Sub Aqua Club. Lectures were given by B. W. Batho on 'medieval ships'; by Miss H. Wylde on 'underwater archaeology in sea, lake and ditch in Italy, 1965'; by B. M. Beeby on 'ancient ports and harbours in England'; by Miss Taylor on 'litter on the sea-bed'; by Miss G. Wever on 'underwater conservation' and by Miss A. Akeroyd on 'sea-level changes in Britain'. A most successful one-day conference on underwater surveying held at the Institute in March, was attended by 70 people; it is hoped to publish the proceedings in 1967.

THE DEPARTMENTS

The Director's general introductory course on archaeology was attended by 25 intercollegiate students.

He continued to act as consultant and observer in connexion with work on the ancient defences of London in the Barbican area. He also excavated in Pembrokeshire as part of a field-course held under his direction.

He also gave a number of lectures to university and other bodies.

Publications:

By Professor Grimes:

'Archaeology in Britain in the Post-War Period', *The Annual Register of World Events* in 1965, pp. 457-461.

HUMAN ENVIRONMENT

Professor: G. W. Dimbleby, B.Sc., M.A., D.Phil. (A.T.)

Reader: I. W. Cornwall, Ph.D. (A.T.)

Assistant: Miss J. M. Sheldon

Technician: P. Porter

Honorary Assistant: Mrs. M. Barton

The number of students working in the Department during the year was 7, 4 being registered for the Ph.D. and 3 for the M.A. Of these, 3 were registered in the Faculty of Science. They worked on the following subjects during the session:

Ph.D.

C. Banks, Mrs. (*née* Grigson) (Faculty of Science): Prehistoric cattle remains from Europe and India.

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- J. G. Evans (Faculty of Science): Land and fresh-water mollusca from Postglacial sediments.
S. Limbrey, Miss (Faculty of Science): A study of the effect of climatic differences on soil formation on basalt in the Canary Islands and the British Isles.
D. Mathewson (Faculty of Arts): Weathering processes on archaeological objects.

M.A.

- A. Akeroyd, Miss: Sea-levels in relation to archaeological sites in Southern Britain.
M. J. Tamplin: Middle Thames brickearths.
B. Wai-Ogosu: Relationships between Man and his Environment in Africa, south of the Sahara.

Both Miss Akeroyd and Mr. Tamplin presented their theses and were awarded the Master's Degree, with Distinction in the case of Miss Akeroyd, who was also given one of the Gordon Childe Memorial Prizes for the session.

This year saw the completion of the first two-year course in the new framework of environmental studies upon an ecological basis. Departmental seminars were run by Dr. V. B. Proudfoot (Durham University) on the 1965 INQUA Congress and by Professor W. J. Mayer-Oakes (University of Manitoba) on lake levels of Lake Agassiz. In June the Department organised a four-day field course for the Institute, centred on Alfriston, Sussex.

Dr. Cornwall was granted leave of absence during the Easter Term to carry out a programme of geological field work in Mexico in conjunction with the Department of Prehistory of the Mexican Instituto Nacional de Antropología e Historia, who provided transport and technical help. The British Council and the Central Research Fund of the University gave financial support. The object of the research was to interrelate, chronologically, Pleistocene and Recent lacustrine deposits, containing evidences of early hunter-collector occupation, in the adjacent basins of Mexico and Puebla, along the line of a new motorway which had exposed sections showing up to 20 metres of airborne volcanic sediments and buried soils. On the way home, Dr. Cornwall was invited by the Universities of Alberta and Calgary to give illustrated talks on this work.

Field and laboratory work has been carried out on a variety of sites in the course of the year, both in this country and abroad, covering periods from the Palaeolithic to Medieval; some involve long-term projects.

The Department was responsible for exhibits illustrating the environmental background in the World of the Bible Exhibition, together with appropriate texts for the handbook.

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It has been giving help to the Geography Department, Aberystwyth, who are beginning work on soil pollen analysis. Mr. Richard Smith of that department spent several days at the Institute in the summer term.

Professor Dimbleby and Dr. Cornwall continued as members of the British Association Committee on Field Experiments. Professor Dimbleby was also appointed a member of the Ancient Agriculture Research Committee.

Professor Dimbleby gave a series of lectures in the University College London conservation course and he and Dr. Cornwall gave several single lectures at Universities other than London and to local societies.

Publications:

By Professor Dimbleby:

'Heathland—A Valuable Waste', *J. Devon Trust for Nature Conservation*, 7 (1965), 296–299.

'Soils and Vegetation History', *Proc. N. Engl. Soils Discussion Group*, 2 (1965), 31–33.

'A Mesolithic Site on Iping Common, Sussex, England', *Proc. Prehist. Soc.* 31 (1965), 85–92 (with P. A. M. Keef and J. J. Wymer).

By Dr. Cornwall:

'The Neolithic Causewayed Camp at Robin Hood's Ball, Shrewton', Report on Soil Samples, *Wilts. Archaeol. and Nat. Hist. Mag.* 59 (1964), 23–25.

'Excavation of a Romano-British Site at Lower Well Farm, Stoke Gabriel, Devon', Report on Animal Bones, *Devon Archaeol. Expl. Soc. Proc.*, 23 (1966), 26.

INDIAN ARCHAEOLOGY

Professor: K. de B. Codrington, M.A. (A.T.).

Five students were registered for higher degrees as follows:—

Ph.D.

T. C. Sharma (Faculty of Arts): Prehistoric archaeology of Assam (a study of neolithic cultures).

A. C. Pal (Faculty of Arts): Protohistoric Studies in the Deccan (title to be agreed).

Miss I. A. R. Naik (Faculty of Arts): The Culture of the Nilgiri Graves with its catalogue collection at the British Museum.

H. A. Ratnayake (Faculty of Arts) (*part-time*): Arts and Crafts of Ceylon.

(The supervision of the work of this student was shared with Mr. H. W. M. Hodges).

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M.A.

S. W. Hatwal (*part-time*): The Palaeography of Brahmi inscriptions.

Of these Miss Naik and Mr. Sharma presented their theses and were awarded Ph.D. degrees.

During the year Professor Codrington visited Paris to advise on a thesis, and Switzerland to discuss field-work.

PREHISTORIC ARCHAEOLOGY

Professor: J. D. Evans, M.A., Ph.D., F.S.A. (*A.T.*)

Lecturers: F. R. Hodson, M.A., Ph.D., F.S.A. (*R.T.*)

J. d'A. Waechter, M.A., Ph.D., F.S.A. (*R.T.*)

Assistant Lecturer: J. Nandris, B.A.

Special Lecturer: T. Sulimirski, Iur.D., Ph.D. (Lwow), Hon. F.S.A.

Honorary Assistant: Mrs. G. Pike, M.A.

Six full-time and 3 part-time students were registered for the Diploma at the beginning of the Session, of whom 4 were in their second year. Three of the latter sat the examination in June and two were successful. There were also 2 full-time occasional students and teaching was provided for 36 intercollegiate students.

Nineteen students were registered for Higher Degrees, as follows:

Ph.D.

M. B. Bender, Miss (Faculty of Arts): The Neolithic cultures of Normandy.

D. C. Biernoff (Faculty of Arts): An analysis of the earliest painted design motifs on pottery from Western Anatolia and Greece.

D. Britton (Faculty of Arts) (*part-time*): Some aspects of the metal industry in Pre-historic Europe, especially in Britain.

C. J. Gallis (Faculty of Arts): Title to be agreed.

R. R. Newell (Faculty of Arts): The origin of farming in Western Europe.

G. Pike, Mrs. (Faculty of Arts): Art of the Megalithic Passage Graves.

B. Rosselló, Mrs. (Faculty of Arts): Geographical and chronological distribution of signs in Palaeolithic Art and their significance.

G. Rosselló (Faculty of Arts): The Chronology of Early Balearic Island Cultures.

G. Watling, Mrs. (Faculty of Arts): The Late Bronze Age Cultures of Southern Britain.

J. Williams (Faculty of Arts): A petrological study of the prehistoric pottery of the Aeolian islands.

(The supervision of the work of this student was shared with Dr. I. W. Cornwall).

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M.Phil.

L. M. Masters (Faculty of Arts) (*part-time*): Stone Circles and Henge Monuments of the British Isles and Ireland.

M.A.

I. M. Davies, Miss: Patterns of prehistoric trade in the British Isles from the Neolithic to the Early Iron Age, with special reference to trade in jet and lignite.

I. Haglund, Miss: Trade connections between Scandinavia, Russia and the British Isles from the Neolithic to the Early Iron Age.

M. A. B. Harlow (*part-time*): A detailed study of the rock art of some sites in Basutoland with special attention to the identification of a stylistic succession.

C. G. Hunt (*part-time*): Interpretations of culture change in Archaeology.

F. F. Petersen: Some aspects of the Rinyo-Clacton culture and its relations to other British Neolithic cultures.

W. W. Phelps: Southern Greece in the Early Bronze Age.

V. N. Rana-Sisodia: Evolution of the Palaeolithic in India.

R. C. Reed: Title to be agreed.

Mr. and Mrs. Rosselló submitted their theses during the course of the year and obtained their doctorates; Miss Davies was awarded the degree of M.Phil, the award to take effect from July, 1967.

Professor Evans and Dr. Hodson continued to act as External Examiners in Archaeology at the Queen's University, Belfast and Cambridge University respectively.

Professor Evans and Mr. Nandris each made study-tours of museums and sites in East European countries during the long vacation. Dr. Sulimirski lectured during the autumn term at Eastern European Universities.

Dr. Hodson continued his work on the finds from Münsingen in Berne in September and April.

Dr. Waechter was granted leave of absence to act as Visiting Professor in the Department of Anthropology of Colombia University, New York from January to June.

Publications:

By Professor Evans:

'Knossos and the Neolithic of Crete', *Atti del VI Congresso Int. delle Sci. Preist. e Protoist.*, II (1965), 220-224.

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By Dr. Hodson:

'A Digital Computer Analysis of Palaeolithic flint assemblages' (with J. E. Doran), *Nature*, 210 (1966), 688-689.

By Mr. Nandris:

Various reviews.

By Dr. Sulimirski:

'A Find from Zamość and its Background' (in Polish with a summary in English), *Archaeologia Polski*, XI (1) (1966), 118-173.

Various reviews.

ARCHAEOLOGY OF THE ROMAN PROVINCES

Professor: S. S. Frere, M.A., V-P.S.A. (*A.T.*)

There were 13 students working in the Department, 8 of whom were registered for the Post-graduate Diploma, 5 for Higher Degrees (3 full-time, 2 part-time).

The following were reading for Higher Degrees:

Ph.D.

W. Manning (Faculty of Arts) (*part-time*): Objects of iron in Roman Britain.

M. W. C. Hassall (Faculty of Arts): The *Notitia Dignitatum*.

Miss S. E. Ramsden (Faculty of Arts): Roman mosaics in Greece.

M.Phil.

P. V. Webster: Romano-British pottery of the West and North Midlands (title to be agreed).

M.A.

K. S. Painter (*part-time*): Roman glass.

During the year Diplomas were awarded to Miss J. S. Baker, Miss N. E. Roberts, Miss J. A. Thomas, Mr. F. A. Blagg and Mr. R. Goodburn.

Regular courses of lectures have been given on Roman Britain and the Western Empire. The former were attended by a total of 16 intercollegiate students.

The Professor gave a number of outside lectures.

Professor Frere, jointly with Mrs. M. A. Cotton, directed a three-week excavation at the Iron Age Hill Fort at Ivinghoe Beacon, and carried out 10 days field-work in

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Devon and Cornwall with Dr. St. Joseph. In addition a short excavation was conducted with Dr. St. Joseph at the Roman fortress at Longthorpe near Peterborough, and excavations were started at the Roman fort of Bowes, Yorkshire, with Mr. B. R. Hartley.

Work has continued within the Department on the restoration of wall plaster from Verulamium; the card index of Celtic coins; and the card index of Romano-British art and objects.

Publications:

By Professor Frere:

Contributions to the new edition of the Oxford Classical Dictionary.

'The End of Towns in Roman Britain' in J. S. Wachter (Ed.) *Romano-British Civitas Capitals* (Leicester, 1966).

Various reviews.

WESTERN ASIATIC ARCHAEOLOGY

Professor: Seton Lloyd, C.B.E., M.A., F.B.A., F.S.A., A.R.I.B.A. (Retd.) (*A.T.*)

Lecturer in Mesopotamian Archaeology: Miss Barbara Parker, O.B.E., F.S.A.

Lecturer in Palestinian Archaeology: P. J. Parr, M.A., F.S.A.

Lecturer in Anatolian Archaeology: J. Mellaart, B.A., F.S.A.

Seminar in Metallurgy and Metal Typology: Mrs. K. R. Maxwell-Hyslop, F.S.A.

The number of full-time students in the Department was 19, of whom 3 were studying Mesopotamian, 2 Iranian, 2 Palestinian and 1 Anatolian archaeology for Higher Degrees. Five students were reading for the Diploma in Mesopotamian (1 part-time), and 5 for the Diploma in Palestinian Archaeology. One full-time occasional student studied the archaeology of Palestine.

Students were registered for Higher Degrees as follows:

Ph.D.

Mesopotamia

C. L. Goff, Miss (Faculty of Arts): New evidence of the cultural developments in Luristan in the late second and early first millennia B.C.

E. D. Caspers, Mrs. (Faculty of Arts): Trade connections between Mesopotamia and southern Persia in the third millennium B.C.

M.A.

G. E. Turner, Late Assyrian Palaces and their antecedents, with special reference to the texts.

P. H. Razavi (Miss): Achaemenid Art in the Western Provinces.

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M.Phil.

Palestine

M. Saghie, Miss (Faculty of Arts): Byblos in the third millennium.

M.A.

R. Dajani: The culture of East Jordan from the 13th to the 7th century B.C.

M.Phil.

Anatolia

G. Danisman: Anatolian architecture up to the Persian Conquest.

Miss C. L. Goff submitted a thesis and obtained her doctorate in July.

Tutorials were given for students studying Akkadian, Hebrew, Arabic and South Arabian at the School of Oriental and African Studies.

Under the auspices of the British Institute of Archaeology at Ankara, Professor Seton Lloyd took an expedition to eastern Turkey to continue excavations begun in 1965 at Kayalidere, near Varto. Political difficulties delayed the granting of an excavation permit for some weeks and on August 19th the field-residence of the expedition was destroyed by an earthquake.

Miss Parker obtained leave of absence to take part in the excavations of the British School of Archaeology in Iraq at Tell Rimah during April and May.

The Department co-operated with the Palestine Exploration Fund in its Centenary Exhibition held at the Victoria and Albert Museum in November, lending material from its collections. Objects from the collections were also lent to other exhibitions.

Dr. Clare Goff received a major award from the University of Oxford Near Eastern Archaeological Fund for excavation in Luristan and Miss J. Farrell was awarded a travel-grant by the British School of Archaeology in Iraq.

Publications:

By Professor Lloyd:

Various reviews.

By Mr. Parr:

Chapters in *World of the Bible*, the catalogue of the Palestine Exploration Fund Centenary Exhibition, 1965.

By Mr. Mellaart:

'Excavations at Çatal Hüyük 1965', *Archäologische Anzeiger* 1 (1966), 1915.

'Çatal Hüyük West', *Anatolian Studies*, XV (1965), 135-156.

INSTITUTE OF ARCHAEOLOGY

DRAWING AND SURVEYING

Lecturer: H. M. Stewart, B.A.

The number of students attending courses was:

Drawing: 24 (11 Diploma, 6 Conservation, 1 Higher Degree, 6 Occasional);

Surveying: 28 (11 Diploma, 9 Conservation, 1 Higher Degree, 7 Occasional).

A course in surveying was also conducted in the Department of Extra-Mural Studies, and lectures in drawing given on behalf of various professional and amateur bodies.

Two students, Misses R. Ludovici and P. L. Berridge, attended the British Institute at Ankara's expedition to Çatal Hüyük, where they assisted with the copying of mural paintings and with general drawing respectively.

PHOTOGRAPHY

Visiting Lecturer: Mr. S. K. Matthews

Senior Technician: Mrs. M. V. Conlon

An increased number of students, 33 in all, took photographic courses, 16 Diploma, 15 Conservation; 2 part-time occasional students were given intensive courses to enable them to join expeditions to the Near East.

The Senior Technician took the initiative during the session in introducing a number of innovations to the work of the Department. During the summer of 1965 alterations to existing accommodation were made to enable research work of a scientific nature, including Infra-Red and Ultra-Violet photography, to be undertaken. With the addition of other equipment it has been possible to make a number of advanced techniques available to students. In this and in other ways the Department is branching out in new directions, the aim of which is to make fuller use of photographic techniques in the study and conservation of archaeological material. An unexpected development was the use of this equipment, at the request of the University's Academic Department, to test documents suspected of having been forged.

The practical photography exercises included work on two London excavations. The annual exhibitions of the students' photographs, which included for the first time Infra-Red and Ultra-Violet work, was staged in the third term and achieved a uniformly high standard.

A visit to the Department by a Museums Association course took place in the first term and included a demonstration and discussion, at which several specialised problems were dealt with.

304 lantern slides and 1,088 prints and enlargements were produced during the year.

REPORT OF THE DIRECTOR FOR THE SESSION 1965/66

CONSERVATION

Senior Lecturer-in-Charge: Miss Ione Gedye, B.A., F.I.I.C.

Senior Lecturer: H. W. M. Hodges, F.I.I.C. (R.T.)

Technician: J. Atkinson

Thirty-seven internal students attended courses in the Department, of whom 19 followed the Conservation course, six being in their second year and two part-time. Visitors who came to study special topics included Miss H. Lechtman, University of New York and Miss L. Davidse, Central Research Laboratory, Amsterdam.

As in previous years work of instructional value to students was undertaken for a number of museums and excavations.

The grant made by the Gulbenkian Foundation to enable the Institute to send a conservator to Rome to study the methods of the Instituto Centrale del Restauro in the treatment of wall-paintings was taken up by Miss Pamela Pratt. Conservation students at the Institute will benefit from the instruction which Miss Pratt is now in a position to impart.

The Department's thanks are again due to Dr. A. E. Werner, Keeper of the Research Laboratory of the British Museum, both for acting as external examiner and for help in other ways. Thanks are also due to Mr. S. Rees Jones of the Courtauld Institute for instructing students in the technology of painting materials; to Mr. Baines-Cope of the Research Laboratory of the British Museum for instruction in the technology, decay and conservation of paper; and to Mr. A. Rixon of the Palaeontology Department of the Natural History Museum for demonstrating the work of his department to second-year students.

Miss R. Baker, Miss P. Berridge, Mr. W. Rackman, Miss R. Ludovici, Miss J. McLachlan and Miss G. Wever obtained the Diploma in Conservation; Miss Baker and Mr. Hackman passing with distinction.

Miss Gedye and Mr. Hodges again lectured on the conservation and examination of pottery for an Extra-mural course.

Mr. Hodges lectured for the Museums Association Diploma in Fine Arts and at a weekend course in Archaeology and Ethnography for the Department of Extra-mural Studies; he was also appointed Recorder for Section H of the British Association.

Miss Gedye and Mr. Hodges continued as Secretary and Treasurer respectively of the United Kingdom Group of the International Institute for Conservation and with their work as abstractors of the technical literature of art and archaeology for the International Institute for Conservation.

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Students from the Department provided technical and excavating services during vacation periods at, in this country, Wharram Percy, North Ormsby, South Witham, North Uist, Chichester, Suddeley Castle, Southampton, Gloucester and Dragonby and, overseas, in Turkey, Denmark and Sicily. Miss G. Wever lectured in a course on conservation for American students held at Oxford.

Publications:

By Mr. Hodges:

'Aspects of pottery in Western Europe' in F. Matson (ed.) *Ceramics and Man* (New York, 1965), pp. 114-123.

'Scientific conservation of antiquities', *Spectrum* (24, May, 1966) pp. 2-5.

CONSERVATION OF HISTORICAL MONUMENTS

Lecturer-in-Charge: W. A. Eden, M.A., F.S.A., F.R.I.B.A. (Theory of Architecture. The Law relating to Ancient Monuments and Historic Buildings).

Lecturers: R. A. Brown, M.A., D.Phil., F.S.A. (Documentary Sources for the History of Architecture in England. Public Records) Mrs. M. P. G. Draper, B.A., F.S.A. (Documentary Sources for the History of Architecture in England. Local and Private Records).

R. G. Gilyard-Beer, M.A., F.S.A. (English Architecture, 597-1540).
Sir John Summerson, B.A., F.B.A., F.S.A., A.R.I.B.A. (English Architecture from 1540).

R. G. Wood, A.R.I.B.A. (Diagnosis and Treatment of Structural Faults in Buildings).

There were 7 students of whom 5 (3 first-year and 2 second-year) were following the Diploma course, and 2 attending one or more lecture courses. There were 2 candidates for the Diploma in the Conservation of Historical Monuments, both of whom were awarded the Diploma.

Visits were arranged during the session to the Palace of Westminster (Victoria Tower document store); the Jewel Tower; the Ministry of Public Building and Works Studio, Regent's Park and the same Ministry's Stone Carving Shop; the dome of St. Paul's Cathedral; Hampton Court Palace; Somerset House; the York Watergate; St. Paul's, Covent Garden; All Saints, Margaret Street; St. Augustine's, Kilburn; and to the following Record Offices:—Public Record Office, Somerset House, House of Lords, Middlesex and Greater London Council, as well as to the British Museum Manuscript Room, Sir John Soane's Museum and the R.I.B.A. Library.

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The Lecturer-in-Charge completed the restoration of Marble Hill House, Twickenham, for the Greater London Council and Mrs. Draper prepared for publication a monograph on the house and the people connected with it.

Mr. P. P. Pratt, who was awarded the Diploma in 1963 was given a two-year appointment as Professor of the Conservation of Historic Buildings in the Technical University of the Middle East, Ankara.

Publications:

By Sir John Summerson:

Inigo Jones, Pelican, 1966.

LIBRARY

Librarian: Miss J. du Plat Taylor, F.S.A.

Assistant Librarian: Miss G. Talbot, M.A., A.L.A.

Chief Library Assistant: Mr. B. M. Beeby, M.A.

Collections Clerk: Miss J. Philips, B.A.

The Library was actively used as increased figures show and was frequently full. Work continued on the material from Professor Zeuner's library and a start was made on sorting the pamphlets from the Human Environment Department which form the last section of his library.

In April the Librarian paid a study visit to Tunis and Motya in connexion with the final report on the excavations; and in June-July, on a grant from the Central Research Fund, she visited Egypt, Jordan, Lebanon and Rhodes to study more comparative material.

Publications:

By Miss Taylor:

Chapter on 'Archaeology' in British Subaqua Club *Diving Manual*, 5th ed. (1966), section G, pp. 1-8.

The following is a summary of the additions made during the year:

<i>Books</i>	497	<i>Pamphlets</i>	620
Exchanged	75	Exchanged	48
Presented	109	Presented	302
Purchased	313	Purchased	270
<i>Periodicals</i>	381	<i>Volumes bound</i>	315

Volumes lent totalled 4,865, the highest month being November (695), the lowest August (136). 51 works were borrowed from outside libraries and 30 lent.

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The following have presented books, periodicals and pamphlets:—

Dr. P. B. Adamson; Dr. M. H. Alimen; Mrs. Amiran; Dr. A. K. Andriomenya; Angola Companhia de Diamantes; Society of Antiquaries of London; Aramco; Miss D. Ashcroft; Australian Institute of Aboriginal Studies; Professor Avnimelech; B. P. Belgium; Badische Anilin- & Soda Fabriken; Dan Barag; Birmingham City Museum and Art Gallery; Mrs. Biro; Professor R. F. Black; George C. Boon; Franck Bourdier; Lady Briscoe; Historical Monuments Commission, Buluwayo; Professor J. A. Callaway; J. H. Chaplin; G. Charrière; CIBA; Professor J. Desmond Clark; Institute of Classical Studies; Henry F. Cleere; Professor K. de B. Codrington; Tojhusmuseet, Copenhagen; Dr. I. W. Cornwall; Dr. J. D. Cowen; Cuban Academy of Science; Cyprus Department of Antiquities; C. H. Dance; Professor G. Dimbleby; Editor of *Discovery*; D. B. Doe; Miss M. S. Drower; Editor of *Endeavour*; Egypt Exploration Society; W. A. Evans; Miss J. Farrell; George C. Fay; Florence: Soprintendenza all'Antichità d'Etruria Museo archeologico; Osvaldo Freire; Professor S. S. Frere; Miss H. Fuller; A. W. Gentry; Professor P. R. Giot; Dr. E. Golson; L. E. Greening; Professor W. F. Grimes; Dr. D. B. Harden; H. W. M. Hodges; Dr. F. R. Hodson; Professor Humphreys; Mrs. M. Hunt; G. Ll. Isaac; R. A. Jairazbhoy; Professor D. M. Lang; Professor Seton Lloyd; T. G. Manby; I. D. Margary; R. J. Mason; F. R. Matson; Mrs. Maxwell Hyslop; Dr. R. S. Merrillees; Paul H. Moisin; John Morris; J. Nandris; Nigeria, Department of Antiquities; Kyriakos Nikolaou; Norwich Castle Museum; Director of Archaeology, Pakistan; David Philips; E. Pyddoke; *Reader's Digest*; Dr. T. C. Sharma; Amer Suleiman; Dr. T. Sulimirski; Roger Summers; Earl H. Swanson, Jr.; Miss G. C. Talbot; Miss J. du Plat Taylor; Peter Throckmorton; Tokyo University Scientific Expedition to W. Africa; Miss O. Tufnell; Dr. G. J. Wainwright; Sir Mortimer Wheeler; G. R. H. Wright; Professor Y. Yadin.

STUDENTS' APPOINTMENTS

Miss A. V. Akeroyd has been appointed part-time Assistant Lecturer in Anthropology in the Department of Geography, Birkbeck College.

Miss J. S. Baker was appointed to the staff of Hertford Museum.

Miss R. Baker has been appointed trainee Research Assistant for organic materials at the Research Laboratory of the British Museum.

Miss P. Berridge has been appointed assistant to Professor E. G. Turner, University College, to work on the treatment of papyrus.

Mr. R. A. Canham was appointed Field Officer at the London Museum.

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Mr. W. Hackman has been appointed Conservation Officer in the Department of Archaeology, Queen's University, Belfast.

Miss G. Joysmith has been appointed to work on the Sutton Hoo material at the British Museum.

Miss R. Ludovici has been appointed Assistant Conservation Officer in the Western Asiatic Department of the British Museum.

Miss J. McLachlan has been appointed Conservation Officer to Buckinghamshire County Museum.

Mr. D. Parish has been appointed Research Assistant in the Department of Anatomy, University of Chicago for archaeological field research in South Africa.

Miss H. Pickering worked for three months as Conservation Officer to the American Research Centre in Egypt.

Mr. P. P. Pratt received a two-year appointment as Professor of the Conservation of Historical Buildings at the Middle East Technical University, Ankara.

Mr. J. E. G. Price has been appointed Technical Assistant (Archaeology and Antiquities Panel), N. W. Museum and Art Gallery Service.

Miss N. E. Roberts was appointed to the staff of Chester Museum.

Miss N. Shaw was invited to advise on conservation problems in the University Museum, Philadelphia, where she spent four months.

Miss A. Stoves has been appointed Research Assistant to Mr. S. Rees Jones at the Courtauld Institute to study techniques of fresco painting.

Mr. M. J. Tamplin has been appointed research associate at the University of Manitoba.

Mr. Al-Tikriti has been appointed Assistant Director in the Iraq Antiquities Department.

Miss G. Wever has been appointed Conservation Officer to the University Museum, Philadelphia.

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INSTITUTE OF ARCHAEOLOGY

COMMITTEE OF MANAGEMENT

THE VICE-CHANCELLOR (Sir Thomas Creed)

THE CHAIRMAN OF CONVOCATION (Dr. C. F. Harris)

THE PRINCIPAL (Sir Douglas Logan)

The Director of the Institute (Professor W. F. Grimes)*

The Director of the Courtauld Institute of Art (or other representative) (Professor G. Zarnecki)

The Director of the Institute of Classical Studies (Professor R. P. Winnington Ingram)

The Director of the Warburg Institute (Professor E. H. J. Gombrich)

The President of the Council for British Archaeology (or other representative) (Dr. D. B. Harden)

The President of the Prehistoric Society (or other representative) (Dr. J. D. Cowen)*

The President of the Society of Antiquaries of London (or other representative) (Sir Mortimer Wheeler)

Recognised or Appointed Teachers in cognate subjects, or Heads of Schools or Institutes in the University:—

Professor P. E. Corbett

Professor A. H. Smith

Professor W. B. Emery

Professor W. Watson

Professor C. Daryll Forde*

(Two vacancies)

Dr. P. S. Noble

Two members of the non-professorial staff nominated by the non-professorial staff through the Academic Board:—

Dr. I. W. Cornwall

Mr. H. W. M. Hodges

The four Professorial Heads of Department of the Institute of Archaeology (ex officio):—

Professor G. W. Dimbleby*

Professor S. H. F. Lloyd

Professor J. D. Evans

(Vacancy)

Five other persons:—

Mr. R. L. S. Bruce-Mitford

Sir Eric Fletcher

Professor J. G. D. Clark

Professor D. McKie

Mr. A. R. Dufty

Dr. P. S. Noble acted as Chairman throughout the session

* Members of the Financial Sub-Committee

PROFESSOR A. H. SMITH

The Committee suffered a serious loss in the death of Professor Smith in May. Professor Smith had been a valued member of the Committee since 1951.

REPORT OF THE DIRECTOR FOR THE SESSION 1966/67

ADMINISTRATION

Director: Professor W. F. Grimes, C.B.E., M.A., D.Litt., F.S.A., F.M.A. (A.T.)*

Secretary and Registrar: E. Pyddoke, F.S.A.

Director's Secretary: Mrs. M. Hunt

Executive Officer: Miss J. V. Brown

Secretarial Assistants: Miss T. S. Halbert

Mrs. M. V. McMullan

Staff matters

The Director was appointed Chairman of the Royal Commission on Ancient Monuments in Wales and Monmouthshire. He continued to serve as Chairman of the Field Studies Council, Council for British Archaeology Committees on Ancient Agriculture and on Industrial Archaeology, the London Topographical Society and the Deserted Medieval Villages Research Group. He continued to act as Honorary Treasurer of the Council for British Archaeology and as a member of the Royal Commission on Historical Monuments (England), the Ancient Monuments Boards for England and for Wales and the special Committee set up by the Minister of Public Building and Works to report on the future of field monuments in Britain. He also served on the Italian Art and Archives Rescue Fund. He continued to represent the University on the Roman and Mediaeval London Excavation Council, the London Society and the Council of the Area Museums Service for South-eastern England.

Professor Dimbleby was appointed to represent the University on the Council for British Archaeology and to the Council's Scientific Committee.

Dr. Cornwall continued as a member of the British Association Committee on Field Experiments.

Dr. F. R. Hodson was granted leave of absence for the session to take up a Senior Research Fellowship in Computing Applications to the Arts and Sciences tenable at Churchill College, Cambridge, and the Atlas Computer Unit of the Science Research Council at Harwell to develop standard ranges of computer techniques for archaeological purposes. Dr. Hodson's election was the first to this Fellowship.

Professor R. G. Goodchild was appointed to the Chair of the Archaeology of the Roman Provinces to take up the appointment in September 1967.

With the consent of the relevant authorities of the University of Oxford, Professor Frere very kindly provided some teaching in the Department while the Chair was vacant. The remainder was covered by Mr. M. W. C. Hassall. The grateful thanks of the Institute are due to Professor Frere for his help.

Thanks are also due to Dr. F. R. Allchin of Cambridge University, who acted as Visiting Lecturer in the Department of Indian Archaeology, after the retirement

*A.T. Appointed Teacher, R.T. Recognised Teacher of the University of London, throughout.

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of Professor Codrington. It is a matter of deep regret that, at least for some time, the work of this Department must come to a halt. Discussions are continuing with the School of Oriental and African Studies, with which the Chair is a joint appointment.

In November Professor Lloyd attended the ceremonial opening of the new Iraqi Museum in Baghdad.

In July Miss Parker and Mrs. Maxwell-Hyslop attended the 15th Rencontre Assyriologique Internationale at Liège.

Dr. Warwick M. Bray took up appointment in April as Lecturer in the Archaeology of Latin America, a post held jointly with the Institute of Latin American Studies.

Mr. M. C. D. Speight was appointed a Research Assistant and Mr. G. J. Sansom a Junior Technician to investigate the environmental significance of arthropod remains from archaeological sites.

Dr. J. G. Evans was appointed a Research Assistant to investigate the relevance of land and freshwater mollusca for archaeology. These projects are being pursued in the Department of Human Environment under the direction of Professor Dimbleby, with the aid of grants from the Natural Environmental Research Council.

Mr. B. M. Beeby resigned as Assistant Librarian in October and Miss H. M. Bell was appointed an Assistant Librarian in March.

Mr. Hassall attended the 7th International Congress of Frontier Studies in Tel Aviv in the spring.

Miss P. M. Pratt was appointed temporary Technician in the Conservation Department.

Visiting Scholars

Among scholars who visited the Institute were Mr. D. Barag, Mr. A. Ben-Tor and Dr. G. Foerster (Hebrew University, Jerusalem), Dr. M. Grbic (Archaeological Institute of Yugoslavia) and Professor M. Tosun (Ankara University).

Public Lectures and Exhibitions

The Special University Lectures were given during the Summer Term by Dr. Werner Krämer of the German Archaeological Institute, Mainz, on 'Latest La Tène and the Roman Conquest North of the Alps'. Attendances averaged 92.

Nine other public lectures, dealing with a variety of subjects, were given during the session; attendances averaged 56. The lecturers included Professor Kemal Balkan (University of Ankara), Mr. Richard E. Lington (Lerici Foundation, Rome,) Dr. Baki Ogun (University of Ankara), Dr. Ian W. Cornwall, Dr. Sverker Janson (Chief Inspector of Ancient Monuments in Sweden), Dr. J. Bouzek (University of Prague) and Mr. R. Soper (British Institute of History and Archaeology in East Africa). Dr. Bouzek's lecture was given under the joint auspices of this Institute and of the Institute of Classical Studies.

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The Institute continued to co-operate with the Extra-Mural Department in teaching for the University Extension Diploma in Archaeology. A number of courses were again held in the building and among the lecturers were past students Dr. M. V. Seton-Williams, Dr. A. Rosenfeld, Dr. G. Wainwright, Mr. G. Jarvis and Mr. B. M. Beeby. The Director and Mr. Parr again acted as External Examiners.

Students

The total number of students registered at the Institute during the session was 133; in addition 57 Intercollegiate students attended courses. Institute students included 32 who were registered for Diplomas (1 part-time); 51 for Higher Degrees (4 part-time); 22 for the course in Archaeological Conservation (2 part-time); and 6 for the course in the Conservation of Historical Monuments. One student was registered for research under Statute 21(iii) and 8 full-time Occasional students and 13 part-time Occasional students attended lectures and used the facilities of the Institute.

Three students were awarded the Diploma in European Archaeology (Section B1: Iron Age and Roman Provinces) (one with Distinction); three the Diploma in Prehistoric Archaeology; five the Diploma in the Archaeology of Western Asia, two in A (Mesopotamia) and three in B (Palestine).

Of the 50 Higher Degree students, 20 were registered for the Ph.D. full-time (2 in the Faculty of Science) and 2 part-time. Twenty-seven were registered for the M.Phil. and M.A. (Old Regulations) full-time and 2 part-time. Ph.D.s were awarded to J. G. Evans (Department of Human Environment) and J. Ll. Williams (Prehistoric Department) in March and M.Phil.s to M. A. B. Harlow (Prehistoric Department), G. E. Turner (Western Asiatic Department) and B. Wai-Ogosu of Human Environment (Department) in July.

Nine students qualified for the Institute's internal Diploma in Conservation (two with Distinction) and three for the Diploma in the Conservation of Historical Monuments.

Twenty-two overseas countries were represented among students registered at the Institute as follows: Australia, 3; Belgium, 1; Canada, 1; Denmark, 3; Federation of South Arabia, 1; France, 1; Greece, 3; India, 3; Israel, 2; Japan, 1; Jordan, 3; Lebanon, 1; Mexico, 1; Netherlands, 2; New Zealand, 2; Nigeria, 1; Poland, 1; Sweden, 1; Tanzania, 1; Trinidad, 1; Turkey, 2; U.S.A., 20. The number of students (55) is the largest that the Institute has accommodated from overseas down to the present time.

Gifts

Gifts of pottery were received from Miss B. de Card, Miss O. Tufnell and the Hon. Mrs. H. Hankey and of flint implements from Mr. D. Parish.

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Gordon Childe Prize and Bequest Fund

A Gordon Childe Prize for 1966/67 was awarded to Dr. J. G. Evans, Department of Human Environment.

The income from the Gordon Childe Bequest Fund for 1966/67 was used in the purchase of a Land Rover for use in connection with Institute field-work.

Margary Fund

Ten students received awards to enable them to travel in France, Jordan, Iran, Iraq, Turkey and the United Kingdom.

TRAINING AND RESEARCH

Institute Field Course

A combined environmental and archaeological course was held in North-east Yorkshire in June, under the direction of Professor Dimbleby. It was the first time the course had been held in this area. The thanks of the Institute are due to several archaeologists (Mr. T. C. M. Brewster, Mr. R. Hayes, Mr. T. G. Manby (a former student) and Mr. Jeffrey Radley) who by making their local knowledge of archaeological sites in the area available contributed materially to the success of the course.

Research Seminar in Archaeology and Related Subjects

The session was a particularly successful one for the Research Seminar, which held eight meetings. The variety of subjects covered is indicated by the following list:

20.10.66 'The stratification of mollusca in chalk soils and their relevance to archaeology.'

Paper by: Dr. J. G. Evans (Institute of Archaeology)

Chairman: Dr. Isobel Smith (Royal Commission on Historical Monuments, England)

10.11.66 'The origins of Rome.'

Paper by: Professor A. Momigliano (University College)

Chairman: Professor C. Daryll Forde (University College)

17.11.66 'Kinship and the family in primates and early man.'

Paper by: Dr. V. Reynolds (Bristol University)

Chairman: Dr. Robin Fox (London School of Economics)

8.12.66 'The domestication of yams.'

and *Paper by:* Dr. J. Alexander (Department of Extra-Mural Studies)

15.12.66 *Chairman:* Dr. J. P. Garlick (University College)

23.1.67 'Electronic computers and archaeology: a computer scientist's viewpoint.'

Paper by: J. E. Doran (Department of Machine Intelligence and Perception, Edinburgh University)

Chairman: Professor R. J. C. Atkinson (University College, Cardiff)

REPORT OF THE DIRECTOR FOR THE SESSION 1966/67

- 6.3.67 'The Roman frontier in Britain, A.D. 140-240.'
Paper by: Dr. M. G. Jarrett (University College, Cardiff)
Chairman: Mr. C. E. Stevens (Magdalen College, Oxford)
- 22.3.67 'The use and abuse of the architect in archaeology.'
Paper by: Mr. M. E. Weaver (Historic Buildings Division, Greater London Council)
Chairman: Mr. P. J. Parr (Institute of Archaeology)
- 1.5.67 'Soil disturbance by burrowing animals with special reference to the activities of the mole.'
Paper by: Dr. T. A. Quilliam (University College)
Chairman: Professor G. W. Dimbleby (Institute of Archaeology)

With a circulating list of more than 350 the Seminar is now securely established as a means of bringing together scholars from different disciplines, humane and scientific, concerned with the past in all the aspects which involve man. The meetings have been distinguished by active discussions which on occasion have opened up the possibility of further development. The discussion of Dr. Alexander's paper on the domestication of yams was so prolonged that a second meeting had to be called to complete it. It provoked the thought that similar meetings should be organised to discuss other crops.

The thanks of the Institute are due to Professor Dimbleby, Dr. P. J. Ucko of University College and Mr. Hodges for their work in the organisation of the Seminar and to Mrs. Dimbleby and Miss Sheldon for dealing with refreshments.

Underwater Research Group

During this year ten meetings were held and ten students became regular members. Four students completed their training as divers.

Details of the session's programme are as follows:—

- October: Open meeting; films and social gathering.
- November: 'Underwater exploration in Malta' by Dr. John Woods (Meteorological Office).
- January: 'Sea levels off Gibraltar' by Dr. J. d'A. Waechter.
- February: 'Coastal research in Britain' by I. F. Joliffe (Bedford College).

Joint meetings were held with the Thames Basin Research Group, Cambridge University Underwater Exploration Society and the University of London Union Subaqua Club to discuss expedition programmes, past and future.

Dr. George Bass, Pennsylvania University, was entertained by the Group in April, together with a number of divers, some of whom were to join his team and he discussed briefly his summer programme.

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Two students joined Dr. Bass in Turkey during the summer and a conservation student worked with Mr. Peter Throckmorton of Pennsylvania Museum on a Roman wreck in Italy. One student made one dive on a Roman wreck in Malta in April; 2 students worked in the Solent area with the Southsea branch of the British Subaqua Club.

As in previous years Miss Taylor accepted general responsibility for the work of the Group.

THE DEPARTMENTS

The Director's general introductory course was attended by 5 intercollegiate students, the drop in numbers reflecting changes in college syllabuses.

He served as External Examiner for Nottingham University and at the invitation of the department concerned acted as adviser to a research student of Reading University.

He continued to act as consultant and observer in connexion with work on the ancient defences of London in the Barbican area of the City and embarked on the excavation of the site of the church of St. Mary Aldermanbury.

He gave a number of outside lectures.

The following student is working under the Director's supervision:

M.Phil.

E. M. Holt, Miss (Faculty of Arts): Study of ancient fields (medieval) with specific reference to early estate maps in the Pennine District.

HUMAN ENVIRONMENT

Professor: G. W. Dimpleby, B.Sc., M.A., D.Phil.(Oxon.) (*A.T.*)

Reader: I. W. Cornwall, Ph.D. (*A.T.*)

Research Assistants: J. G. Evans, Ph.D.

M. C. D. Speight, B.Sc.

Assistant: Miss J. M. Sheldon

Chief Technician: P. Porter

Technician: G. Sansom

Honorary Assistant: Mrs. M. Barton

The number of students working in the Department during the year was 6, 5 being registered for the Ph.D. and 1 for the M.A. Of these, 3 were registered in the Faculty of Science. The students worked on the following subjects during the session:

Ph.D.

C. Banks, Mrs. (*née* Grigson) (Faculty of Science): Prehistoric cattle remains from Europe and India.

REPORT OF THE DIRECTOR FOR THE SESSION 1966/67

- J. G. Evans (Faculty of Science): The stratification of mollusca in chalk soils and their relevance to archaeology.
- A. Kosse (Faculty of Arts) (joint registration with Professor Evans): Pedological investigation of settlement sites.
- S. Limbrey, Miss (Faculty of Science): A study of the effect of climatic differences on soil formation on basalt in the Canary Islands and the British Isles.
- D. Mathewson (Faculty of Arts): Weathering processes on archaeological objects.

M.Phil. and M.A. (Old Regulations)

- R. G. Coppen (Faculty of Arts): Solution phenomena in geological deposits and soil profiles.
- B. Wai-Ogosu (Faculty of Arts): Relationships between man and his environment in Africa south of the Sahara.

Both Mr. Evans and Mr. Wai-Ogosu presented their theses in the course of the session and were awarded a Doctorate and Master's degree respectively. Mr. Evans received the Gordon Childe Memorial Prize for the year.

The normal pattern of lectures was supplemented by a series of seminars for those students taking the environmental option in the Diploma in Prehistoric Archaeology. In addition, some seminars were held on special topics, including 'Factors governing natural preservation', 'The writing of theses'; and Professor G. F. Mitchell of Trinity College, Dublin, led a seminar on 'The glaciation of the Scilly Isles'.

Once again the Institute's field-course was organised by the department. This year it was extended to a week and held in north-east Yorkshire, using Malton as a base.

Professor Dimbleby and Dr. Cornwall gave a number of lectures to University societies and other outside bodies.

The research programme of the department was extended through the award of two research assistantships by the Natural Environment Research Council. The first of these was in entomology and Mr. M. C. D. Speight (Imperial College) has been appointed to study insect remains in archaeological deposits for a period of three years. The second award was for a similar study of molluscan remains, which is being carried out by Dr. J. G. Evans, also for three years.

Dr. Cornwall continued to work on volcanic samples collected in Mexico in 1966.

Besides these lines of research, the department has also been involved in field and laboratory studies on seventeen sites throughout the country dealing with many periods from the Mesolithic to the Medieval. In addition work was carried out on a Palaeolithic site at El Bezez in the Lebanon.

Grateful acknowledgment is made of the continuing help given by the Botanical Supply Unit of the University in providing reference material for the department's seed collection.

INSTITUTE OF ARCHAEOLOGY

Publications:

By Professor Dimbleby:

Plants and Archaeology, John Baker, 1967, 187 pp.

'Man's impact on his environment', *J. Soil Assoc.*, April, 1966, 107-112.

'The environment of early man', *Spectrum* 31 (1966), 10-11.

'Moorland as an ecological workshop', *Exmoor Rev.* 8 (1967), 17-18.

'The experimental earthwork on Overton Down, Wiltshire, England: the first four years', *P.P.S.* 32 (1966), 313-342 (with P. A. Jewell).

'The Lanhill Long Barrow, Wiltshire, England. Appendix IV. Charcoals', *P.P.S.* 32 (1966), p. 85.

INDIAN ARCHAEOLOGY

Visiting Lecturer: Dr. F. R. Allchin, Ph.D., F.S.A.

Two students were registered for higher degrees as follows:

Ph.D.

A. C. Pal (Faculty of Arts): Protohistoric studies in the Deccan.

M.A. (Old Regulations)

S. W. Hatwal (*part-time*): The palaeography of Brahmi inscriptions.

PREHISTORIC ARCHAEOLOGY

Professor: J. D. Evans, M.A., Ph.D., F.S.A. (*A.T.*)

Lecturers: F. R. Hodson, M.A., Ph.D., F.S.A. (*R.T.*)

J. d'A. Waechter, M.A., Ph.D., F.S.A. (*R.T.*)

Lecturer in Latin American Archaeology: W. M. Bray, Ph.D., M.A. (joint post with Institute of Latin American Studies)

Assistant Lecturer: J. Nandris, B.A.

Special Lecturer: T. Sulimirski, Iur.D., Ph.D.(Lwow), Hon. F.S.A.

Honorary Assistant: Mrs. G. Pike, M.A.

There were 13 full-time students and 1 part-time student registered for the Diploma at the commencement of the session. Seven of these were in their second year, and 3 successfully sat the Diploma examination in June. Of the others, 2 are taking a third year to complete the course (one of these is the part-time student referred to above), 1 had to break off the course during the year for personal reasons and another transferred to a higher degree.

Teaching was provided for 2 full-time occasional students and 30 intercollegiate students. One student was registered for research under Statute 21(iii).

Twenty students were registered for higher degrees, all in the Faculty of Arts, as follows:—

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Ph.D.

- M. B. Bender, Miss: The Neolithic cultures of north-west France.
- D. Biernoff: An analysis of the earliest painted design motifs on pottery from western Anatolia and Greece.
- I. M. Crawford: Late prehistoric changes in aboriginal cultures in Kimberley, Western Australia (joint registration with Department of Anthropology, University College).
- C. Doumas: The Early Bronze Age in the Cyclades.
- A. Kossé: Pedological investigation of settlement sites (joint registration with Professor Dimbleby).
- R. R. Newell: The origin of farming in western Europe.
- G. Pike, Mrs.: The art of the Megalithic Passage Graves.
- G. Watling, Mrs. (*née* Putt): The Late Bronze Age cultures of southern Britain.
- J. L. Williams: A petrological study of the prehistoric pottery of the Aeolian Islands with special reference to the stratigraphical sequence. (The supervision of the work of this student was shared by Dr. I. W. Cornwall).

M.Phil. and M.A. (Old Regulations)

- E. Bader, Rev.: Levantine influences in the Early and Middle Bronze Ages in the Aegean basin.
- B. M. Beeby: The La Tène period in east central Europe.
- R. J. Carey: Prehistory of Greece.
- F. R. Dowling, Miss: Later prehistoric lithic industries of the British Isles.
- I. Harrison, Mrs. (*née* Haglund): Relations between Scandinavia and Russia in prehistoric times.
- M. A. B. Harlow: A detailed study of Rock Art of some sites in Basutoland with special attention to the identification of a stylistic succession.
- F. F. Petersen: Some aspects of the Rinyo-Clacton culture and its relations to other British Neolithic cultures.
- W. W. Phelps: Southern Greece in the Early Bronze Age.
- V. N. Rana-Sisodia: The evolution of the Palaeolithic in India.
- R. C. Reed: Prehistory of Cornwall.
- M. J. Rowlands: A study of technological change due to the introduction of iron in the period Late Bronze Age to Early Iron Age in Europe.
- M. G. Spratling: The technology and typology of the metalwork of the pre-Roman Iron Age in England and Wales.

During the course of the year Mr. Williams and Mr. Harlow submitted their theses and were awarded the Ph.D. and M.Phil. degree respectively.

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Professor Evans and Dr. Hodson continued to serve as External Examiners at the Queen's University, Belfast, and Cambridge University respectively. The Professor gave a number of outside lectures.

Professor Evans made a study tour of museums in Spain and Portugal in July and August 1967.

Dr. Waechter continued to work on the preparation of Ksar 'Akil monograph and on a report on stone implements from the gravels of Keswick, Norfolk.

Because of Dr. Hodson's absence in Cambridge, his courses were taken by Miss J. Close-Brooks, M.A., a former student of the Institute.

Mr. Nandris continued work on his Ph.D. thesis.

Publications:

By Professor Evans:

The Western Mediterranean, Fasc. 57 of the Revised Edition of Vols. I and II of the Cambridge Ancient History (with Dr. G. E. Daniel).

Various reviews.

By Dr. Hodson:

'Some experiments in the numerical analysis of archaeological data', *Biometrika*, 1966, p. 53.

By Dr. Waechter:

Various reviews.

By Mr. Nandris:

Various reviews.

ARCHAEOLOGY OF THE ROMAN PROVINCES

Professor:

Assistant Lecturer (temporary): M. W. C. Hassall, M.A.

There were 13 students in the Department, 5 of whom were registered for the Post-graduate Diploma, 8 for Higher Degrees (2 part-time).

The following were reading for Higher Degrees, all in the Faculty of Arts:

Ph.D.

J. P. Alcock, Miss (*part-time*): Food in Roman Britain.

M. W. C. Hassall: The *Notitia Dignitatum*.

W. H. Manning (*part-time*): Objects of iron in Roman Britain.

S. E. Ramsden, Miss: Roman mosaics in Greece.

P. V. Webster: Romano-British pottery of the West and North Midlands.

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M.Phil.

S. K. Digby: Coin reform of Aurelian and its effects on Roman Britain.

R. Goodburn: A systematic survey of the development and history of the Roman villa in Britain.

P. V. Webster, Mrs. (*née* Wareing): Romano-British bronze statuettes.

During the year Diplomas were awarded to Mr. G. M. R. Davies, Mrs. M. I. Martin and Mrs. M. Roxan, the last-named receiving a mark of Distinction.

Courses of lectures were given by Mr. Hassall on Roman Britain and on the Western Empire. The Roman Britain course was attended by 18 intercollegiate students.

Mr. Hassall attended the 7th International Congress of Frontier Studies during the Easter vacation and visited Continental sites and museums; he also assisted at excavations at Cirencester.

WESTERN ASIATIC ARCHAEOLOGY

Professor: Seton Lloyd, C.B.E., M.A., F.B.A., F.S.A., A.R.I.B.A. (Retd.) (*A.T.*)

Lecturer in Mesopotamian Archaeology: Miss Barbara Parker, O.B.E., F.S.A.

Lecturer in Palestinian Archaeology: P. J. Parr, M.A., F.S.A. (*R.T.*)

Lecturer in Anatolian Archaeology: J. Mellaart, B.A., F.S.A.

Seminar in Metallurgy and Metal Typology: Mrs. K. R. Maxwell-Hyslop, F.S.A. (*R.T. Retd.*)

The number of full-time students in the Department was 22, of whom 3 were studying the Archaeology of Mesopotamia, 3 Anatolia, 5 Palestine and 1 Iran for Higher Degrees. Five students were reading for the Diploma in Mesopotamian Archaeology, 5 for the Diploma in Palestinian Archaeology, and 1 for the Diploma in Anatolian Archaeology. There were 2 full-time occasional students studying the archaeology of Palestine.

Five students successfully sat for the Diploma examinations, 2 in Mesopotamian and 3 in Palestinian archaeology.

Students registered for Higher Degrees, all in the Faculty of Arts, were as follows:

Mesopotamia

Ph.D.

E. D. Caspers, Mrs.: Iranian connections with the southern trade routes of Mesopotamia.

M.Phil. and M.A. (Old Regulations)

G. E. Turner: Late Assyrian palaces and their antecedents, with special reference to the texts.

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J. C. Farrell, Miss: The cultural relationship between northern and southern Mesopotamia in the Uruk and Jemdet Nasr periods.

P. Razavi, Miss: Achaemenid art in the western Provinces.

Palestine

Ph.D.

E. Oren: The Bronze Age cemeteries of Beth Shan.

M.Phil. and M.A. (Old Regulations)

R. Dajani: The culture of East Jordan from the 13th to 7th century B.C.

V. Izon, Miss: Archaeological evidence for the period of the Judges.

D. Price Williams: Archaeological evidence for Israelite religion.

M. Sagieh, Miss: Byblos in the third millennium.

Anatolia

M.Phil.

W. M. N. Campion: The relations between Anatolia and neighbouring countries in the 2nd millennium B.C.

G. Danisman: Anatolian architecture up to the Persian Conquest.

S. L. Levine, Miss: Neolithic industries of Palestine and Syria.

G. E. Turner presented his thesis in June and was awarded an M.Phil. with distinction.

Mr. Parr, as the recipient of a Hayter Award, spent six weeks in the Middle East in April and May, visiting museums and sites in connection with his publication of the Petra excavations. He also visited Saudi Arabia with a view to future excavations in that country.

Under the sponsorship of the Institute, Dr. Clare Goff conducted excavations at Baba Jan in Luristan.

Mrs. Maxwell-Hyslop received a grant from the Oxford Near Eastern Fellowship Fund for the completion of her work on Western Asiatic jewellery.

Publications:

By Professor Lloyd:

Private houses and graves in the Diyala Region, University of Chicago Press, Oriental Institute Publication LXXXVIII (1967), 361 pp.

Various reviews.

By Mr. Parr:

'The date of the Qasr Bint Far'un at Petra', *Jaarbericht Ex Oriente Lux* 19 (1967), 550-557.

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'La date du barrage du siq à Petra', *Revue Biblique* LXIV (1967), 45-49.

Various reviews.

By Mr. Mellaart:

Excavations at Çatal Hüyük, 1965. Fourth Preliminary Report', *Anatolian Studies* XVI (1966), 165-191.

'Çatal Hüyük, a neolithic city in Anatolia', Albert Reckitt Archaeological Lecture, 1965. *Proc. Brit. Acad.* LI, 201-212.

'The Earliest Settlements in Western Asia', *Cambridge Ancient History*, Fasc. 59 (1967), 61 pp.

'Çatal Hüyük: une ville néolithique du VIIe millénaire en Anatolie', *Archeologia* 17, (1967), 42-57.

The Chalcolithic and Early Bronze Ages in the Near East and Anatolia, Khayats, Beyrouth (1966), 196 pp.

Çatal Hüyük. A neolithic town in Anatolia, Thames and Hudson, London (1967), 228 pp.

By Mrs. Maxwell-Hyslop:

(with H. W. M. Hodges) 'Three iron swords from Luristan', *Iraq* XXVIII, 2 (1966), 164-176.

Review of M. E. L. Mallowan, *Nimrud and its remains*, *Arch. J.* CXXIII (1966), 223.

DRAWING AND SURVEYING

Lecturer: H. M. Stewart, B.A.

The number of students attending courses was:

Drawing: 31 (15 Diploma, 9 Conservation, 4 Higher Degree, 3 Occasional)

Surveying: 32 (15 Diploma, 10 Conservation, 4 Higher Degree, 3 Occasional)

Six lectures on Archaeological Surveying and one on Drawing were given in the Department of Extra-Mural Studies. In addition one lecture on each of these subjects was contributed in the Diploma course of the Museums Association.

At the end of the session an exhibition was held of drawings by students of the Institute.

Publications:

By Mr. Stewart:

'Traditional Egyptian Sun Hymns of the New Kingdom', *Institute of Archaeology Bulletin* 6 (1966), 29-74.

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PHOTOGRAPHY

Visiting Lecturer: Mr. S. K. Matthews

Senior Technician: Mrs. M. V. Conlon

The number of students working in the department has increased. In addition to 21 Conservation students and 14 Diploma students, there were 3 part-time students doing specialised work to assist in research. Mr. D. Barag worked on Syrian and Palestinian glass of the Roman and Byzantine periods; Dr. J. Vardaman (Oxford University) on Nabatean inscriptions and inscriptions of the Herodian Dynasty; and Mrs. H. Smith on Egyptian objects and papyrus, the last in preparation for her work on the excavations at Saqqara, which are under the direction of Professor W. B. Emery and Mr. H. Smith of University College.

During the first term lectures on the theory of photography were given by Mr. Matthews. The practical courses, under the direction of the Senior Technician, included, as well as general photography in studio and field, macrography, micrography, infra-red and ultra-violet work. Tuition on microscope photography was made possible by the borrowing of equipment from the Conservation Department at arranged hours, but it is intended that the Photographic Department shall acquire its own equipment to enable it to develop fully the research potential of archaeological photography.

In the time available to them, Diploma students were able to cover all photographic techniques in their course and photographs produced by them at two excavations, at London Bridge and Moorgate, were accepted by the excavators.

The annual exhibition of photographs by second-year Conservation students was held in July. The exhibition led to a request from Dr. T. A. Quilliam of University College for an article on 'Some aspects of photography in archaeology' for inclusion in *Medical and Biological Illustration*.

The Department was fully used during both term-time and vacations. Special advice on photographic problems was given to Mr. David Parish, a former student now working for the University of Chicago Department of Anatomy in South Africa, and the facilities of the Department were made available to him in connection with this work. Advice was also given in the planning of a new photographic department in the Aylesbury Museum. Visits were received from Photographic Technicians from Birmingham Museum and the School of Oriental and African Studies, who were shown various techniques used for scientific work.

In July Mr. Matthews lectured to the Museums Association course on 'Photography in the Museum and Art Gallery'.

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CONSERVATION

Senior Lecturer-in-Charge: Miss Ione Gedye, B.A., F.I.I.C.

Senior Lecturer: H. W. M. Hodges, F.I.I.C. (R.T.)

Technician: Miss P. Pratt

Honorary Assistant: Miss A. Plowden

Twenty-eight students attended courses in the Department, of whom 22 followed the Conservation course, 11 being in their second year and 2 part-time.

Visitors who came to study special topics included Miss Jean McLachlan (Buckinghamshire County Museum): treatment of murals; Miss Frances Ainger (British Institute of Persian Studies): field conservation.

As in previous years, work of instructional value to students was undertaken for a number of museums and excavations.

The Department reaped the benefit of Miss Pratt's term of study at the Istituto Centrale del Restauro in Rome in the treatment of wall-paintings in that second-year students were instructed in the treatment and transfer of murals for the first time.

The Department's thanks are again due to Dr. A. E. Werner, Keeper of the Research Laboratory of the British Museum, both for acting as external examiner and for help in other ways; and to Mr. Baines-Cope of the same department for instruction in the technology, decay and conservation of paper.

Miss M. Bell, Miss E. Dowman, Miss J. Escritt, Miss P. Knowles, Mr. D. Leigh, Miss S. Lord, Mr. B. Madsen, Miss D. Reeves and Mr. C. Slack obtained the Diploma in Conservation, Miss Dowman and Miss Escritt passing with distinction.

Miss Gedye and Mr. Hodges again lectured on the examination and conservation of pottery for an Extra-mural course and to the Museums Association course for Archaeologists. They continued as Secretary and Treasurer respectively of the United Kingdom Group of the International Institute for Conservation.

Miss Plowden advised on the lifting of a mosaic floor in Rome on behalf of the British School at Rome.

Students from the Department undertook conservation, restoration or excavating work at the Ministry of Public Building and Works Laboratory in London, Dragonby, Fishbourne, Wharram Percy, West Stow, Baba Jan, Florence, Jerusalem, Taranto and Annamurium, Turkey.

Publications:

By Mr. Hodges:

(With Mrs. Maxwell-Hyslop) 'Three iron swords from Luristan', *Iraq* XXVIII, 2 (1966), 164-176.

INSTITUTE OF ARCHAEOLOGY

CONSERVATION OF HISTORICAL MONUMENTS

Lecturer-in-Charge: W. A. Eden, M.A., F.S.A., F.R.I.B.A. (Theory of Architecture. The Law relating to Ancient Monuments and Historic Buildings).

Lecturers: R. A. Brown, M.A., D.Phil., F.S.A. (Documentary Sources for the History of Architecture in England. Public Records).

Mrs. M. P. G. Draper, B.A., F.S.A. (Documentary Sources for the History of Architecture in England. Local and Private Records).

R. G. Gilyard-Beer, M.A., F.S.A. (English Architecture, 597-1540).

Sir John Summerson, B.A., F.B.A., F.S.A., A.R.I.B.A. (English Architecture from 1540).

R. G. Wood, A.R.I.B.A. (Diagnosis and Treatment of Structural Faults in Buildings).

Seven students registered in the Department, of whom 5 (3 second-year and 2 first-year) were following the course for the Diploma in the Conservation of Historical Monuments. The remaining 2 attended lecture courses only. There were 3 candidates for the Diploma, all of whom passed the examination and were awarded the Diploma. A fourth who had attended all the necessary courses whilst reading for the degree of M.Phil. but had not followed a curriculum of practical training, passed the written examinations. He is now undertaking the required practical work.

Visits were made to Lincoln, King's Lynn, Audley End, Somerset House (cellars), St. Paul's Covent Garden, the York Watergate, Burlington House and Estate and Strawberry Hill. The following museums and record offices were also visited: The British Museum (Print Room, Manuscript Room and Map Room); National Register of Archives; Somerset House (Probate Registry); Greater London Council and Middlesex Record Offices; St. Thomas' Hospital; and the Bedford Estate Office.

The Lecturer-in-Charge directed the restoration of Lauderdale House, Waterlow Park. Mrs. Draper worked on the Covent Garden volume of the *Survey of London*.

LIBRARY

Librarian: Miss J. du Plat Taylor, F.S.A.

Assistant Librarians: Miss G. Talbot, M.A., A.L.A.
Miss H. M. Bell, B.A.

Collections Clerk: Miss J. Philips, B.A.

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A Library student, Miss Sandy Eu, from Leeds School of Librarianship, worked in the Library as Assistant during the autumn term and Miss Anne Wedeles, a classical student, was employed for the first part of the spring term.

During the year, work was begun on the revision of the Library classification, and the re-arrangement of some sections of the Library.

In March, the Librarian visited Malta in connection with projects for the Underwater Research Group. During July and August she directed the second part of the excavation season at Gravina in southern Italy on behalf of the British School at Rome.

The following is a summary of the additions made during the year:

<i>Books</i>	460	<i>Pamphlets</i>	564
Exchanged	89	Exchanged	38
Presented	128	Presented	238
Purchased	243	Purchased	288
<i>Periodicals</i>	436	<i>Volumes bound</i>	13

Volumes lent totalled 4,643, the highest month being November (713) and the lowest August (47). Thirty-one works were borrowed from outside libraries and 74 lent.

The following have presented books, periodicals and pamphlets:

Dr. P. B. Adamson; Dr. J. Alarcão; Dr. F. R. Allchin; Dr. E. Anati; Society of Antiquaries of London; Aramco; Professor Avnimelech; B. P. Belgium; D. Barag; B. M. Beeby; A. Ben-Tor; O. Bilgi; Mrs. Biro; G. C. Boon; Historical Monuments Commission, Bulawayo; G. F. Carter; Gordon Childe Bequest; Mrs. P. M. Christie; CIBA; R. J. Clarke; Institute of Classical Studies; Professor K. de B. Codrington; Dr. I. W. Cornwall; J. D. Cowen; R. W. Dajani; C. Dance; Professor G. W. Dimbleby; Chr. Doumas; G. C. Dunning; Editor of *Endeavour*; W. A. Evans; Dr. G. E. Fay; T. S. Ferguson; Per Fett; Dr. H. Field; Professor S. S. Frere; P. S. Garlake; Professor P.-R. Giot; Gregg Press; Mrs. Hacker; Dr. D. B. Harden; H. W. M. Hodges; Dr. F. R. Hodson; F. Hole; Dr. K. M. Kenyon; A. Kosse; D. Krantzalov; A. D. Lacaille; Institute of Latin American Studies; Inheritors of Louis Le Breton; Museo Etnológico do Dr. Leite de Vasconcelos; Miss E. Macnamara; I. D. Margary; Mrs. Maxwell-Hyslop; J. V. S. Megaw; J. Mellaart; Professor Hallam L. Movius; Professor Nakagawa; Mrs. Negbi; Miss T. M. I. Newbould; Dr. I. H. Nish; Dr. K. P. Oakley; K. Paaver; Afonso do Paço; High Commissioner for Pakistan; P. J. Parr; D. Philips; Dr. Wendell Phillips; Miss W. E. Phillips; M. W. Prausnitz; Dr. E. Ripoll Perelló; School of Oriental and African Studies; Professor N. C. Scott; Miss J. Sheldon; H. M. Stewart; Dr. T. Sulimirski; Mrs. Sussman; Miss G. C. Talbot; Miss J. du Plat Taylor; C. Wilkinson; Dr. M. V. Seton Williams; Professor D. J. Wiseman; Executors of Sir Leonard Woolley; G. R. H. Wright; Dr. S. Yessaian.

INSTITUTE OF ARCHAEOLOGY

STUDENTS' APPOINTMENTS

Mr. B. Beeby: Extra-mural Lectureship in Archaeology, University of Nottingham.

Miss M. Bell: Conservation Officer, Winchester Museum.

Mr. D. Biernoff: Lecturer in Department of Anthropology, University of New Brunswick, Canada.

Miss D. Collon: Research Assistant, Department of Western Asiatic Antiquities, British Museum.

Mr. G. M. R. Davies: Junior Assistant, Chester Museum.

Miss I. Davies: Temporary Assistant at the Smithsonian Institution, Washington.

Mr. S. Dove: Assistant Conservation Officer in the Prehistoric and Medieval Department, British Museum.

Miss J. Escritt: Assistant Conservation Officer, Conservation Laboratories, Ministry of Public Building and Works.

Miss J. Farrell: Temporary Assistant, Palestine Exploration Fund.

Miss M. Geschier: Secretary, British School of Archaeology in Iraq.

Mr. T. Holland: Temporary Assistant, British School of Archaeology in Jerusalem.

Miss P. Knowles: Conservation Officer, Horniman Museum.

Mr. D. Leigh: Conservator, Department of Archaeology, University of Southampton.

Miss S. Lord: Assistant Conservation Officer, Prehistoric and Medieval Department, British Museum.

Mr. D. S. Noble: Lecturer in History, Whitelands College, Putney.

Miss M. Pearce: Assistant, Birmingham Museum.

Mrs. G. Pike: Assistant, Department of History, University of Reading.

Miss D. Reeves: Assistant Conservation Officer, Ministry of Public Building and Works.

Miss C. Spencer: Museum Assistant, Natural History Museum.

Miss S. Walston: Conservation Officer (part-time), Western Asiatic Department, British Museum.

Miss M. White: Conservation Officer, Museums Service for North-East England.

Dr. J. L. Williams: Research Assistant, Department of Anthropology, University College.

